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INFORMATION ASYMMETRY AND RELIGIOUS SEASONALITY

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ABSTRACT

This paper examines the seasonality in information asymmetry as proxied by the probability of informed trading (PIN) in relation to the Islamic holy month of Ramadan. It utilizes data collected from Boursa Kuwait, covering the period from January 2013 to December 2018, and pooled panel regressions to test the hypothesis that increasing religiosity during Ramadan would reduce the probability of informed trading. The results reveal that the PIN increases during Ramadan relative to other Islamic calendar months, contrary to our hypothesis. Further tests reveal that institutional trading activities increase during Ramadan compared to individual trading. We argue that the presence of sophisticated traders (institutional traders) in the market during Ramadan contributes to the observed increase in the PIN effect. This study contributes to the literature by exploring the relationship between religiosity and information asymmetry in the context of an Islamic financial market, offering new insights into the behaviour of institutional traders during the holy month of Ramadan. We refer this phenomenon as the "Ramadan PIN effect", which differs from the previously documented "Ramadan returns effect" and "Ramadan liquidity effect".

Keywords: PIN, Ramadan effect, Institutional investor.
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I. INTRODUCTION

Religion may frame traders' behavior (Hilary & Hui, 2009; Kumar et al., 2011), and thus the outcomes of the stock market (Fabozzi et al., 2008; Al-Awadhi & Dempsey, 2017; Alhomaidi et al., 2019), leading to stock market seasonality (Al-Awadhi, Alhashel, & Bash, 2024; Jurkatis, 2022). However, it is still unclear to what extent religious seasonality interacts with information asymmetry.

Islamic societies describe financial ethics in terms of religion (Zaher & Hassan, 2001). According to earlier studies, religion can influence financial decision (Kumar, 2009; Al-Awadhi & Dempsey, 2017), deters crime (Evans et al., 1995) and managerial moral hazard (Du, 2013). Islamic laws also forbid certain financial practices such as insider trading (Taj El Din, 1996) because it goes against Islamic ethical codes of social trust and equality of treatment (Qureshi, 1982).

This study investigates whether stock markets in Islamic societies experience less informed trading during Ramadan. We anticipate that a greater level of religiosity during Ramadan deters insider trading (Taj El Din, 1996). This brings us to our main hypothesis: the probability of informed trading is lower during Ramadan than any other Islamic month (i.e. non-Ramadan months).

Probability of informed trading (PIN) is used in this paper as an information asymmetry proxy (Kang, 2010).[1] We calculate the monthly rolling PIN, following Gan et al. (2015) and Al-Awadhi, Alhashel, & Bash (2024). The results contradict our hypothesis. We find that the stock market experiences more informed trading during Ramadan. Repeating our experiments using a Tobit and also an alternative PIN Proxy following Yan & Zhang (2012) with the boundary solutions that improve the original PIN model of the estimators gives consistent outcomes. Our additional analysis indicates that during Ramadan, institutional trading on the stock market increases relative to individual trading. Thus, we may attribute our results of increase in informed trading during Ramadan to the increase in institutional traders' participation.

By investigating if religious seasonality interacts with information asymmetry, this study contributes to the existing body of knowledge. As far as we know, this is the first study to explore the impact of Ramadan on informed trading. We use data (intraday data) for all companies listed on the Boursa Kuwait for the period from January 2013 to December 2018.

The implications of our study are important for the main players in stock markets of countries with Muslim majority. For example, market-makers are advised to be aware of the PIN increase during Ramadan and widen bid–ask spread in order to minimize the cost of trading with better-informed traders (adverse selection).

The remainder of this paper is organized as follows. The section that follows discusses the literature and hypothesis development. The third section discusses the estimation method. The fourth section discusses data and descriptive statistics. The empirical tests and further analyses are described in Sections 5 and 6, respectively, the discussion and research implications are presented in Section 7, and Section 8 concludes.

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1 Given its suitability for addressing concerns like information event uncertainty, discreteness, and tick size variation, PIN has found widespread use in the literature as a measure for informed trading.

II. LITERATURE REVIEW

2.1. Research Background

Social norms have a considerable impact on the investment choices of individuals (Al-Awadhi & Dempsey, 2017). Consequently, these societal conventions influence an individual's conduct when trading in the stock market and the resulting consequences (Al-Awadhi, 2021).

Ramadan is the ninth month of the Islamic calendar and is regarded as the holy month in Islam. During this time, Muslims abstain from various activities such as eating, drinking, and some other physical indulgences from sunrise until sundown. The purpose of this practice is to prioritize worship of God (Bia[1]kowski et al., 2012). The emphasis of Muslims during Ramadan moves towards their devotion to God and their religious practices. This shift in concentration may have an impact on their investment behavior and the stock markets trading practices.

The effect of religiosity on both physical and mental well-being has a clinical justification. Fasting of Ramadan, can reduce levels of anxiety (Daradkeh, 1992; Knerr & Pearl, 2008; Lau et al., 2023). Previous research provides evidence of the impact of religious holidays on stock markets (Frieder & Subrahmanyam, 2004; Mustafa, 2008; Mehran et al., 2012; Pantzalis & Ucar, 2014; and Yousaf et al. 2018). Frieder & Subrahmanyam (2004) show that Jewish and Christian religious holidays have a positive impact on the S&P500. The seasonality of Ramadan has been widely investigated, and findings have stipulated convincing indication that there is certainly a seasonal pattern in Ramadan returns. These findings are founded on research conducted in different countries with a substantial Muslim population, such as Pakistan, Egypt, Saudi Arabia, Turkey, Indonesia, Morocco, Oman, Qatar, Kuwait, and Jordan (Almudhaf, 2012; Bia[1]kowski et al., 2012; Al-Khazali, 2014; Hassan & Kayser, 2019). In four different stock exchanges, and for the period from 1996 to 2007, Almudhaf (2012) notices a pattern of seasonal variations in the returns of Ramadan. Hassan & Kayser (2019) and Husain (1998) show that the Islamic month of Ramadan influences stock returns and market volatility. Husain (1998) suggests that the decline in market volatility during Ramadan may be attributed to the increased engagement of Muslim nations in socio-religious activities. Based on Al-Hajieh et al. (2011), there is a strong establishment that Ramadan is associated with positive stock yields.

A number of recent studies show that there is a positive relationship between stock returns and Ramadan (Bia[1]kowski & Yaghoubi, 2021; Chaouachi, 2021; Ali et al. 2023). Empirical research by Bia[1]kowski & Yaghoubi (2021) shows stock returns are higher returns and less volatile during Ramadan. Their analysis makes use of data that covers 11 Muslim countries and spans the years 2009 to 2018. Based on information gathered from the Tunis Stock Exchange between 2009 and 2019, Chaouachi (2021) presents similar findings, i.e. higher returns as well as lower volatility during Ramadan. Similar patterns of higher profitability and less market volatility are noted by Lopez-Martin (2022) in the bitcoin industry.

Markowitz (1952) and Friedman & Savage (1948) lay down the groundwork for a sizable body of research on trading behavior in finance. Several studies have found a relationship between differences in speculative behavior and variations in risk aversion, which can be influenced by religious beliefs (Kumar, 2009; Kumar et al., 2011; Kumar & Page, 2014). According to Markowitz's (1952) mean-variance

paradigm, variations in investor behavior could explain events that conventional financial theory is unable to explain. Variability in risk aversion is one explanation for the diversification paradox, which describes the issue of certain investors not diversifying their holdings. Statman first put forth this theory in 2004.

Islam promotes a set of moral standards and ethical precepts that prohibit immoral behavior (Taj El Din, 1996). Many stock market behaviors are forbidden by Islamic Shariah Law, including excessive speculation that causes share price volatility unrelated to company performance or economic fundamentals (Ahmed, 2000; Al-Masri, 2007; Kamali, 1996; Naughton & Naughton, 2000). Excessive speculation is forbidden in Islam because it is similar to gambling, which is forbidden because it is very unpredictable and dangerous (gharar).

Different patterns of speculative behavior can be observed by investors with differing faith views and degrees of religious devotion (Kumar, 2009; Kumar et al., 2011; Kumar & Page, 2014). Moreover, there may be differences in the degree of religious observance within a certain faith. Throughout the month of Ramadan, Muslims' level of religious devotion is increased by religious ceremonies (Campante & Yanagizawa-Drott, 2015). This change in the degree of religiosity offers a chance to investigate how religion affects stock market behavior. This study looks into the possibility of a relationship between a rise in Muslim religious observance during Ramadan and a fall in stock market activity, as shown by trading volume, value, and frequency.

2.2. Hypothesis Development

The impact of religious holidays on the performance of the stock market has been extensively studied and documented in academic finance literature (Goodell et al., 2023; Hassan & Kayser, 2019). In the study conducted by Frieder and Subrahmanyam (2004), it is found that there is a positive correlation between returns on the S&P500 index and the occurrence of Catholic and Jewish religious holidays in Christian and Jewish contexts. Scholarly research has been conducted within the Islamic framework to measure the patterns of stock market returns and volatility during the month of Ramadan. For example, Husain (1998) analyses the seasonality of Ramadan, concentrating on the market volatility and returns of the Pakistani equity market. The researcher observes a significant decrease in stock market volatility during the month of Ramadan, but this decrease is not accompanied by a significant change in average returns. Despite a decrease in volatility, Seyyed et al. (2005) note that there is no significant change in average returns on the Saudi Arabian stock market during Ramadan. The authors believe that the decrease in market volatility observed during Ramadan can be attributed to religious beliefs, as individuals tend to focus on socio-religious activities during this time.

Scholarly research has been conducted to investigate the phenomenon of seasonality during the month of Ramadan with larger data sets and broader contextual frameworks, encompassing numerous stock markets inhabited primarily by Muslim populations (Almudhaf, 2012; Al-Khazali, 2014). According to the research of Almudhaf (2012), an examination of the period between 1996 and 2007 reveals the presence of Ramadan return seasonality in four of the twelve

examined markets. These are the Kuwaiti, Jordanian, Pakistani, and Turkish markets. Al-Khazali (2014), observes a limited presence of Ramadan return seasonality across the twelve markets analyzed from 1989 to 2012.

According to the theoretical framework proposed by Tokic (2014), speculation is associated with heightened levels of volatility. Empirical research has revealed that speculative behaviors and return volatility are positively correlated (Scheinkman & Xiong, 2003; Dorn & Sengmueller, 2009; Pan et al, 2016).

According to Islamic principles, participation in stock market trading is permissible, whereas engaging in speculative activities are either discouraged or prohibited. Insider trading is also prohibited by Islamic law (Taj El Din, 1996) because it violates fundamental principles of Islam: social trust and equality of treatment.

This study examines whether Islamic financial markets face lower informed trading during Ramadan due to higher levels of religiosity. It is important to mention that PIN can be influenced by numerous factors beyond the ethical considerations (e.g., changes in liquidity, participation by different trader types). Lai & Windawati (2017) find that in Indonesia and Malaysia stock markets, the liquidity is higher during and around Ramadan than the rest of the year due to supply and demand incentives. In addition, participation by different types of traders also affects the PIN. For example, Al-Awadhi, Bash, AlGharabali, Al-Hashel, & Jamaani (2024) find that the frequency of trading in the Boursa Kuwait as a whole and the ratio of individual trading volume to total trading volume decrease during the holy month of Ramadan due to Muslims' religious practice of fasting. They discover that institutional buy-side trading has significantly increased while individual buy-side trading as a percentage of overall trading volume has significantly decreased.

Our fundamental hypothesis is thus: the probability of informed trading is lower during Ramadan than any other Islamic month (non-Ramadan months).

III. ESTIMATION METHOD

We begin by calculating the daily buy and sell trades for each stock to estimate the PIN. Following Lee & Ready (1991), we apply the tick rule to determine the direction of each transaction (based on price changes in comparison to the prior price). A buy (sell) transaction occurs when the transaction price is higher (lower) than the prior price. Trade is categorized as a buy (sell) when the price does not move but the prior tick change tick is up (down).

The classical PIN models (Easley et al., 1996; Easley & O'hara, 1992) state that the likelihood of perceiving the number of buy (Buy_d) and sell ($Sell_d$) trades on any day d is

$$L(Buy_d, Sell_d) =$$
$$(1-\delta)e^{-(\mu+\varepsilon_b)}\frac{(\mu+\varepsilon_b)^{Buy_d}}{Buy_d!}e^{-\varepsilon_s}\frac{\varepsilon_s^{Sell_d}}{Sell_d!} + \varrho\delta e^{-\varepsilon_b}\frac{\varepsilon_b^{Buy_d}}{Buy_d!}e^{-(\mu+\varepsilon_s)}\frac{(\mu+\varepsilon_s)^{Sell_d}}{Sell_d!}$$
$$+(1-\varrho)e^{-\varepsilon_b}\frac{\varepsilon_b^{Buy_d}}{Buy_d!}e^{-\varepsilon_s}\frac{\varepsilon_s^{Sell_d}}{Sell_d!} \quad (1)$$

where $\otimes = (\varrho, \delta, \mu, \varepsilon_b$, and $\varepsilon_s)$ are the trading procedure parameters. P is the probability of an event with information. Δ is the probability of an information event established on bad news and $1 - \delta$ is the probability an information event established on good news. μ represents the arrival rate of daily informed traders buying (selling) in response to positive (negative) news when an information event occurs. E_b is the uninformed traders' arrival rate of daily submitted buy orders. E_s is the arrival rate of uninformed traders' daily sell orders.

Assuming days are unrelated, the probability of a sequence of daily offers and sales over trading days d equals 1, and D is the daily product of likelihood:

$$L(\otimes \mid M) = \prod_{d=1}^{D} L\,(\otimes \mid Buy_d, Sell_d) \tag{2}$$

where $M = ((Buy_1, Sell_1), \ldots, (Buy_d, Sell_d))$ is the dataset. The PIN was based on the original concept by Easley & O'hara (1992) is

$$PIN = \frac{\varrho\mu}{\varrho\mu + \varepsilon_b + \varepsilon_s} \tag{3}$$

To solve the boundary solution problem in classical methods with maximum likelihood estimation, we estimate the improved PIN of Gan et al., (2015) using cluster analysis. Based on the daily order imbalance $X_d = Buy_d - Sell_d$, this method splits the trade data into three categories: (1) a group of days with a positive event that has the highest average order imbalance, (2) a group of days with a negative event that has the lowest average order imbalance, and (3) a group of days with no event in the cluster's center.

To link to the closest data points, we employ the bottom-up hierarchical agglomerative clustering (HAC) algorithm with complete linkage, where every observation begins in a separate cluster and the closest pair of clusters is combined in every step until there are n clusters (three in our case).

The weights w_b, wg, and w_n are assigned to data clusters with positive news, negative news, or no event, respectively. In addition, $ABuy_g$ ($ABuy_b$) and $ASell_g$ ($ASell_b$) represent the daily average buys and sells in positive (negative) event clusters, respectively. As a result, the average buys and sells in the no-event cluster are embodied by $ABuy_n$ and $ASell_n$, respectively. Using algebra and the number of days in every cluster, we calculate the following structural parameters:
The intensity of uninformed trading buy:

$$\widehat{\varepsilon_b} = \frac{w_b}{w_b + w_n} ABuy_b + \frac{w_b}{w_b + w_n} ABuy_n \tag{4}$$

The intensity of uninformed trading sell:

$$\widehat{\varepsilon_s} = \frac{w_g}{w_g + w_n} ASell_g + \frac{w_n}{w_g + w_n} ASell_n \tag{5}$$

The intensity of informed trading:

$$\hat{\mu} = \frac{w_g}{w_b + w_g}\left(ABuy_g - \widehat{\varepsilon_b}\right) + \frac{w_b}{w_b + w_g}\left(ASell_b - \widehat{\varepsilon_s}\right) \tag{6}$$

Probability of information event:

$$\hat{\varrho} = w_b + w_g \tag{7}$$

Bad news conditional probability:

$$\hat{\delta} = \frac{w_b}{w_b + w_g} \tag{8}$$

As a result,

$$PIN = \frac{\hat{\varrho}\hat{\mu}}{\hat{\varrho}\hat{\mu} + \widehat{\varepsilon_b} + \widehat{\varepsilon_s}} \tag{9}$$

IV. DATA AND DESCRIPTIVE STATISTICS

4.1. Data

Boursa Kuwait intraday data from January 2013 through December 2018 are used for the purpose of this study. Georgian daily data are converted to the Islamic calendar for easier analysis. Twelve months make up the Islamic calendar: Counting from the first, Muharram is followed by Safar, then Rabia Awal, Rabia Thani, Jumaada Awal, Jumaada Thani, Rajab, Sha'ban, Ramadan, Shawwal, Dhul-Qi'dah, and Dhul-Hijjah.

4.2. Descriptive Statistics

Using intraday data for January 2013 to December 2018, we estimate the monthly 60-day rolling PIN, as in Gan et al. (2015) and Al-Awadhi, Alhashel & Bash (2024). According to our hypothesis, Islamic investors would participate in less informed trading during the holy month of Ramadan due to the Islamic principle of equality and trust.

Figure 1 (see Appendix) demonstrates the average PIN throughout the Islamic calendar months. During Ramadan, average monthly PINs on the stock market are significantly higher than during other months. Table 1 presents the summary statistics for the main variable (PIN). The summary statistics suggest that during Ramadan, the stock market shows a higher mean and standard deviation of PIN compared to other Islamic calendar months. The mean and median equality tests in Table 2 suggest that Ramadan has a significantly higher average PIN for both the mean and median than non-Ramadan months. These results contradict our hypothesis.

Table 1.
PIN Summary Statistics

Islamic Month	Mean	Median	Std
1	0.2030	0.1905	0.0909
2	0.2038	0.1946	0.0897
3	0.2070	0.1944	0.0945
4	0.2202	0.2099	0.0826
5	0.2207	0.2116	0.0833
6	0.2049	0.1935	0.0857
7	0.2016	0.1866	0.0933
8	0.2128	0.1933	0.1036
9 (Ramadan)	**0.2254**	**0.2078**	**0.1070**
10	0.2191	0.2028	0.1009
11	0.2135	0.1979	0.1018
12	0.1988	0.1861	0.0887

This table reports the summary statistics of our main variable (PIN) based on the 12 Islamic calendar months from January 2013 to December 2018.

Table 2.
PIN Equality Tests

	Mean Equality (Equal Variances)	Mean Equality (Un-Equal Variances)	Median Equality
Ramadan	0.2254	0.2254	0.2078
Non-Ramadan	0.2098	0.2098	0.1960
Difference	0.0155	0.0155	0.0118
P-value	0.0000	0.0000	0.0000

This table reports the mean and median equality tests for our main variable (PIN) based on the 12 Islamic calendar months from January 2013 to December 2018. The p-values of the mean equality test correspond to the t-test. The p-values of the median equality test correspond to a Wilcoxon/Mann—Whitney signed rank median test.

V. EMPIRICAL TESTS

We employ a panel data regression model to test our hypothesis, as it offers several methodological advantages over cross-sectional or time-series models alone. Panel data combines observations across multiple entities (firms) over several time periods, enabling us to account for both inter-individual (cross-sectional) and intra-individual (temporal) variations. This approach allows us to control for unobserved heterogeneity by incorporating fixed or random effects, thereby reducing omitted variable bias (Baltagi, 2008). Moreover, panel data facilitates the examination of dynamic changes in the relationship between the independent and dependent variables over time, which is particularly important for capturing evolving behavioral patterns. In addition, panel regression improves the precision of our estimates by increasing the number of data points, and it helps mitigate multicollinearity and estimation bias that might arise in purely cross-sectional or time-series analyses (Baltagi, 2008; Hsiao, 2014). These strengths make panel data regression a robust and reliable method for empirical investigation in our study. We thus use a panel regression to investigate the seasonality of the PIN over the

Islamic calendar months while adjusting for firm-specific traits. We estimate the following model:

$$PIN_{i,m} = \alpha_0 + \alpha_1 D_9 + \varepsilon_{i,d} \quad (10)$$

where $PIN_{i,m}$ represents stock *i's* monthly PIN regressed on the Ramadan dummy variable D_9, which equals 1 if the month is Ramadan and 0 otherwise. $\varepsilon_{i,d}$ is the error term.

The coefficient α_1 indicates whether Ramadan has higher or lower PINs than the other months of the Islamic calendar. The null hypothesis is that α_1 equals 0, whereas we expect that it will be significantly less than 0. The outcomes of the panel and Tobit regressions are shown in Table 3. The results show that the coefficients for the variable of interest (D_9) are positive as well as significant, suggesting that, on average, PIN increases during Ramadan relative to the other Islamic calendar months. In addition, the findings of the ordinary least squares (OLS) analysis may be affected by heteroskedasticity and autocorrelation due to the fact that the data are pooled (panel). We deal with this problem by adding dummies for the industry and the year (Arellano, 2003). After accounting for the industry, the year, and both the industry and the year together, our findings have not changed. Table 3 shows the results obtained from the Tobit regression that are well-matched with our earlier findings.

The panel regression results in Table 3 are consistent with the results of the mean and median equality tests, suggesting that, on average, PIN increases during Ramadan compared to other Islamic calendar months.

Table 3.
PIN Panel and Tobit Regression

PIN	(1)	(2)	(3)	Tobit
B0	0.2098***	0.2093***	0.2169***	0.2170***
	(0.0004)	(0.0008)	(0.0019)	(0.0063)
D9	0.0154***	0.0165***	0.0163***	0.0164***
	(0.0012)	(0.0014)	(0.0014)	(0.0012)
Sector FE	NO	NO	YES	YES
Year FE	NO	YES	YES	YES

This table reports the OLS and Tobit regression results for panel regression seasonality of our PIN proxy regressed on the dummy variable of Ramadan days (D9), covering the period between January 2013 and December 2018. *, **, and *** denote $p < 0.1$, $p < 0.05$, and $p < 0.01$, respectively.

VI. FURTHER TESTS

6.1. Alternative PIN Proxy

As a robustness check, we follow Yan & Zhang (2012) and use the boundary solutions that improve the original PIN model of the estimators in Easley & O'hara (1992) and Easley et al. (1996). Following Yan & Zhang (2012), we limit the initial values of the probability parameters ϱ and δ (between zero and one) and have equidistant values within the interval. We estimate the initial values of the arrival

rates μ, ε_b, and ε_s using the moment conditions for the probability distributions of daily purchases and sales. The arrival rates μ, ε_b, and ε_s are unbounded (from zero to positive infinity).

Table 4 shows the results of the regression using YZPIN following Yan & Zhang (2012). These results are in line with our previous findings, suggesting that the relationship between $YZPIN_{i,t}$ and D_9 is positive and significant.

Table 4.
YZPIN Panel and Tobit Regression

YZPIN	(1)	(2)	(3)	Tobit
B0	0.1627***	0.1648***	0.1223***	0.1223***
	(0.0003)	(0.0008)	(0.0017)	(0.0057)
D9	0.0102***	0.0121***	0.0114***	0.0114***
	(0.0011)	(0.0012)	(0.0012)	(0.0011)
Sector FE	NO	NO	YES	YES
YEAR FE	NO	YES	YES	YES

This table reports the OLS and Tobit regression results for the panel regression seasonality of our second PIN proxy (YZPIN) regressed on the dummy variable of Ramadan days (D9) covering the period between January 2013 and December 2018. *, **, and *** denote $p < 0.1$, $p < 0.05$, and $p < 0.01$, respectively.

6.2. Trading Activity Analysis

To understand the reason behind the increase in the PIN during Ramadan, we analyze the change in institutional trading activity during Ramadan compared to other Islamic calendar months (Al-Najjar et al., 2023).

To this end, we use unique data from the Kuwait Clearing Company, which consists of daily individual and institutional trading volumes for each stock for January 2013 to December 2018. We construct the institutional trading ratios as follows:

$$IBR_{i,m} = \frac{IBV_{i,m}}{TV_{i,m}} \tag{11}$$

and

$$ISR_{i,m} = \frac{ISV_{i,m}}{TV_{i,m}}$$

where $IBR_{i,m}$ is the institutional buy ratio, $IBV_{i,m}$ is the volume of institutional buy-side trading during month m for stock i, and $TV_{i,m}$ is the total trading volume during month m for stock i. $ISR_{i,m}$ is the institutional sell ratio, and $ISV_{i,m}$ is the volume of institutional sell-side trading during month m for stock i.

The panel regression results for institutional trading activity in Table 5 suggest that Ramadan has a significantly higher average institutional buying ratio ($IBR_{i,m}$) than do non-Ramadan months. These results may explain the increase in PIN

during Ramadan. We might assume that the increase in sophisticated traders in the market during Ramadan (institutional traders) leads to an increase in the PIN (Al-Awadhi, Alhashel, & Bash, 2024).

Table 5.
Institutional Trading Activity Panel Regression

	(1)	(2)	(3)
Institutional Buying Ratio (IBR)			
B0	0.2027***	0.1999***	0.2042***
	(0.0006)	(0.0011)	(0.0038)
D9	0.0102***	0.0100***	0.0092***
	(0.0020)	(0.0022)	(0.0021)
Institutional Selling Ratio (ISR)			
B0	0.1721	0.1735	0.1749
	(0.0005)	(0.0011)	(0.0036)
D9	0.0026***	0.0025***	0.0020***
	(0.0020)	(0.0020)	(0.0020)
Sector FE	NO	NO	YES
YEAR FE	NO	YES	YES

This table reports the panel regression seasonality test for the trading activity of institutional traders. The institutional trading ratios are regressed on the dummy variable of Ramadan days (*D9*), covering the period between January 2013 and December 2018. $IBR_{i,m}$ is institutional buying ratio and $ISR_{i,m}$ is institutional selling ratio. *, **, and *** denote $p < 0.1$, $p < 0.05$, and $p < 0.01$, respectively.

VII. DISCUSSION AND RESEARCH IMPLICATIONS

The main hypothesis of this study is that "the probability of informed trading is lower during Ramadan than any other Islamic month (non-Ramadan months)." However, the findings reveal increased PIN during the holy month of Ramadan, a phenomenon we refer to as the "Ramadan PIN effect", which represents a continuation of distinct religious seasonality, differing from the previously documented, such as "Ramadan returns effect" and "Ramadan liquidity effect". These results challenge the notion that increased religiosity during holy periods reduces information asymmetry and enhances market volatility documented by previous literature (Wasiuzzaman & Al-Musehel, 2018, Białkowski et al., 2012, Al-Khazali, 2014, Seyyed et al., 2005).

A plausible explanation for the observed effect could be a decline in individual trading activity, as they are more engaging in religious and spiritual practices, which results in a greater share of institutional trading. This shift can lead to more information asymmetry in the market, as institutional traders mostly possess superior access to information compared to individual traders (Griffin et al., 2012). Hendershott et al. (2015) show that institutional traders have superior information-processing abilities that allow them to predict market-moving announcement before it becomes publicly available. Moreover, institutional traders usually have better access to information compared to individual traders, which exacerbates information asymmetry (Tudor, 2021). Hence, we can argue that the increase in PIN effect may be attributed to a shift in investor composition and behaviour in

the holy month. It is worth to mention that institutions trade for various reasons such as liquidity, portfolio rebalancing, index tracking. Therefore, they are not always trade based on private information. For example, Harvey et al. (2025) find that institutional investors engage in portfolio rebalancing frequently in response to changes in allocation objectives or calendar schedules. Syamala et al. (2014) find that institutional investors prefer to hold liquid stocks to minimize price impact. Frino et al. (2005) show that index funds, by rebalancing their portfolios during index revisions well before the effective date of an index update, index funds can gain from increased returns and reduced trading expenses. Another explanation would be a reduced speculative behaviour during the holy month due to reduced trading hours and increased religiosity of individual market participants. Particularly, an increased perception of religious values among traders may result in a reduced interest in margin trading and speculation, as these practices are prohibited under Islamic Shariah law (Hassan & Kayser, 2019).

The study has a far reaching theoretical and practical implications but should be limited to both time and sample. For instance, the findings support the view that the effect of religiosity on market dynamics is complex and can vary depending on the composition of market participants. Thus, during Ramadan, the decreased participation of individual investors exacerbates the information asymmetry held by institutional traders, thereby increasing PIN; but at the same time as mentioned earlier, that there might be also other reasons for this behavior (liquidity, portfolio rebalancing, index tracking). As for practical implications, the observed increase in PIN during Ramadan suggests that market makers should consider widening bid-ask spreads during the holy month to mitigate the adverse selection costs associated with trading against better-informed institutional traders. Furthermore, regulators could benefit from closely monitoring institutional trading during Ramadan to ensure that increased information asymmetry does not lead to unfair market practices.

VIII. CONCLUSION AND RECOMMENDATION

8.1. Conclusion

Previous research shows that religiosity has an influence on stock market seasonality. In this study, we aim to determine whether religiosity seasonality interacts with informed trading. To solve such issue, we examined data from Kuwait. We examine whether the Islamic principles of equality and trust suppress informed trading among traders. Inconsistent with our hypothesis, we discover a positive seasonal pattern of the PIN effect during Ramadan: the "Ramadan PIN effect".

We have reached numerous conclusions to justify our results that contradict our hypothesis. First, we find a seasonal Ramadan pattern for the PIN effect. The outcomes of the monthly regression tests demonstrate that there is a substantial variation in the PIN pattern between Ramadan and other Islamic months. Second, this Ramadan PIN pattern can be accredited to the change in trading activity. Specifically, during Ramadan, individuals dedicate more time to spiritual practices and their religiosity rises. Therefore, we can anticipate that they will avoid prohibited excessive speculation, causing an increase in the proportion

of institutional trading relative to individual trading, leading to higher levels of informed trading. However, we should be very cautious with this inference as institutions trade for various reasons (liquidity, portfolio rebalancing, index tracking) and not always based on private information. Third, no prior studies address the Ramadan PIN effect. This effect differs from other Ramadan anomalies like the "Ramadan returns effect" or the "Ramadan liquidity effect". Lastly, in our opinion, we believe that the seasonal PIN pattern sheds new light on institutional investors' role.

8.2. Recommendation

Market practitioners and regulators should be aware of this seasonal risk. We advise practitioners to adjust trading strategies to account for higher adverse selection costs and for market makers to widen bid-ask spreads. Regulators should consider increased market surveillance and promote more timely corporate disclosures during Ramadan to ensure market integrity.

Our study has several limitations that point to promising directions for future research. It would be valuable to test whether this Ramadan effect appears in other Muslim-majority countries and in different asset classes like sukuk or commodities.

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APPENDIX

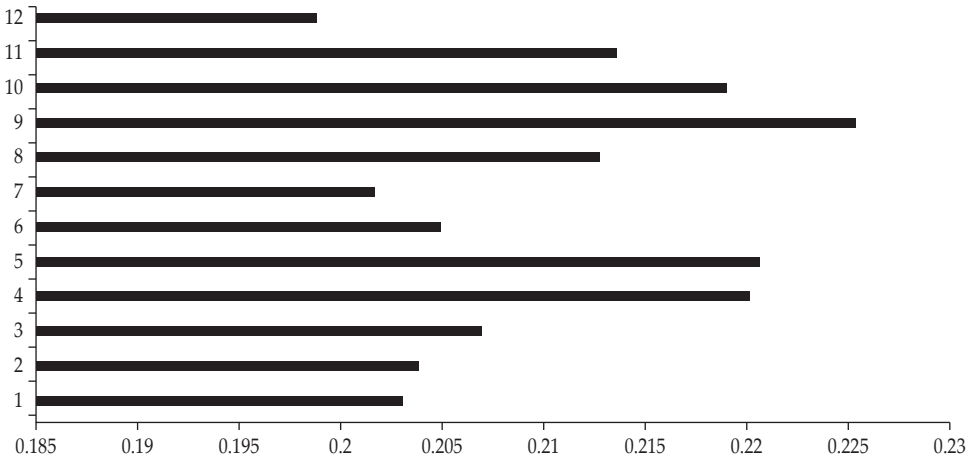

Figure 1.
PIN Over Islamic Calendar Months

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