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INFORMATION DISTRIBUTION AND INFORMED TRADING IN MIXED AND ISLAMIC CAPITAL MARKETS

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ABSTRACT

The correlation between volume and frequency with return volatility can explicate the information distribution process and informed traders' transaction behavior in a stock market. In this study, the Indonesian stock market represents the mixed market, while the Saudi Arabian stock market represents the Islamic market. We find that 94% and 96% of sharia-compliant stocks in Indonesia and Saudi Arabia follow the Mixture of Distribution Hypothesis (MDH). Consequently, we may conclude that sharia-compliant stocks in both markets are informationally efficient. However, we find that informed traders tend to behave differently in both markets. In the Indonesian market, informed traders exhibit competitive behavior in 95% of sharia-compliant stocks and strategic transaction behavior in only 5% of the stocks. In contrast, in the Saudi Arabian market, we find that informed traders exhibit competitive behavior in only 38% of the stocks and strategic behavior in 62% of the stocks. The findings suggest that social and religious contexts may affect market participants' behavior.

Keywords: Indonesia; informed trading; Saudi Arabia; SIAH; MDH

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1. INTRODUCTION

Efficient Market Hypothesis suggests that every market participant can access and utilize information. Therefore, it is almost impossible to obtain abnormal returns (Fama, 1970). Extant literature also documents that Islamic capital markets tend to show lower market efficiency than conventional capital markets. The level of efficiency of sharia capital markets highly depends on the level of liquidity, institutional characteristics, and the behavior of market participants (Sensoy, Aras, & Hacihasanoglu, 2015).

Volume-volatility relations can identify the information distribution process (Karpoff, 1987). The process of information distribution consists of the Mixture of Distribution Hypothesis (MDH) and

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the Sequential Arrival Information Hypothesis (SIAH). MDH assumes that the relationship between volume and price changes occurs contemporaneously and weakly exogenous (Clark, 1973). According to the assumption of MDH, the market participants nonrandomly and simultaneously obtain information (Clark, 1973). Meanwhile, SIAH information distribution process assumes that volume and return volatility occurs in lagged series, so that volume and price changes can predict each other (Copeland, 1976). SIAH assumes that market participants can randomly and sequentially obtain the information. However, they are unable to obtain the information simultaneously (Clark, 1973). SIAH can indicate the change in the price equilibrium. The final equilibrium occurs when the market participants have the same perspective (Copeland, 1976).

Besides, volume and frequency relations with return volatility (price changes) can indicate the characteristics of informed traders' transaction model. The transaction model consists of strategic and competitive transaction models (Easley, Kiefer, & O'Hara, 1997). In the strategic transaction model, the market participants conduct the transaction in the increasing frequency with low trade size. In contrast, in the competitive transactions model, the market participants conduct the transaction in lower frequency with the increasing amount of value of the transaction (Easley et al., 1997). Informed traders with similar opinions will conduct a competitive transaction model, while informed traders with different opinions will conduct a strategic transaction model (Jones, Kaul, & Lipson, 1994).

This research intends to study the information distribution and informed trading processes, based on volume and frequency relations with return volatility. We study sharia-compliant stocks in mixed and Islamic stock markets because fundamental information, as well as social structures, including religious structures, may influence market participants' behavior (Canepa & Ibnrubbian, 2014). The Indonesian stock market is the proxy of the mixed capital market because both sharia-compliant and conventional stocks are listed. The proportions of sharia-compliant stocks in Indonesia is only 13.47% in 2017 (MSCI, 2018b). Meanwhile, the Saudi Arabian market is the proxy of the Islamic capital market because the Saudi Arabian capital market contributes to 73.18% of Islamic capital markets in the Middle East (MSCI, 2018a).

Utilizing 62 sharia-compliant stocks in Indonesia and 50 sharia-compliant stocks in Saudi Arabia, we find that in the Indonesian market 58 (94%) stocks follow the Mixture of Distribution Hypothesis (MDH) process, and 4 (6%) stocks follow the Sequential Information Arrival Hypothesis (SIAH) process. Similarly, in the Saudi Arabian market, 48 stocks (96%) follow the MDH, and 2 (4%) stocks follow the SIAH. We also learn that informed traders in the Indonesian market exhibit competitive behavior in 59 (95%) stocks and strategic transaction behavior in only 3 (5%) stocks. Conversely, informed traders in the Saudi Arabian market tend to exhibit competitive behavior in only 18 (38%) stocks and strategic behavior in 31 (62%) stocks.

We organize the paper in five sections beginning with the Introduction. Section 2 deliberates the Literature Review. Section 3 discusses the Methodology. Section 4 presents the Results and Discussion. Section 5 concludes the paper.

2. LITERATURE REVIEW

2.1. Efficient Market Hypothesis

Efficient Market Hypothesis (EMH) consists of three forms: weak form, semi-strong form, and strong form (Fama, 1970). In the weak-form EMH, the company's share price only reflects historical information, such as prices and volumes. In the semi-strong form, the information set consists of historical and publicly available information, such as financial statements. In the strong-form EMH, the current stock price reflects all information, including private information. In other words, market participants can obtain all relevant information (Fama, 1970).

2.2. Information Distribution Hypotheses

The Mixture of Distribution Hypothesis (MDH) is one of the hypothetical theories explaining the distribution of capital market information. MDH assumes that price changes occur randomly, and therefore it does not allow the previous period information to predict the next period (Clark, 1973). Based on the assumption of MDH, the market participants obtain information in a non-random and simultaneous fashion. Hence, the price changes have a contemporaneous correlation with the volume (Clark, 1973).

Besides MDH, Sequential Information Arrival Hypothesis (SIAH) is another hypothetical theory describing the distribution of capital market information. SIAH allows the volume and volatility to exhibit lagged series relationship. Henceforth, current volumes may predict the next period price changes, and the current price changes can predict volumes in the next period (Copeland, 1976). According to SIAH's assumption, the market participants obtain information randomly and sequentially. Hence, there will be a sequential change of equilibrium. The initial equilibrium occurs since the information enters the stock market, and the final equilibrium occurs when every market participant information has obtained the same perspective (Copeland, 1976).

2.3. Information Distribution and Informed Trading

Analysis of the correlation between volume and price changes is essential in order to understand the structure of financial markets. The relationship between volume and price changes can be used to indicate the existence of private and public information (Karpoff, 1987). Moreover, Harris (1987) states that the relations between volume and volatility depend on the level of information intensity in the capital market. An increase in information intensity leads to a stronger relationship between volume and volatility. In another study, Jones et al. (1994) find that trading frequencies significantly affect price changes at any level of market capitalization, while volume only significantly affects the changes in price in low-market capitalization stocks. Additionally, trading frequency tends to increase with the increase of new information in the capital market (Harris, 1987).

The GARCH model (Bollerslev, 1986) can identify the information distribution (latent factor) by determining the changes of volatility persistence before and after the latent variable is placed into conditional variance (Lamoureux & Lastrapes, 1994). Based on the GARCH model, Pyun, Lee, & Nam (2000) identify the information distribution process based on the volatility persistence level. MDH process assumes that the volatility persistence level decreases after the absorption of volume

into the conditional variance. The decrease of volatility persistence indicates that volume is the proxy of the information arrival. In contrast, SIAH assumes that volatility persistence will not decrease after volume is included in the conditional variance (Omran & McKenzie, 2000). The stable volatility persistence indicates the correlation between volume and weak contemporaneous price changes (Arago & Nieto, 2005; Darrat, Rahman, & Zhong, 2003)

In addition to volume and volatility relation, the analysis of trade frequency and volatility relations is also relevant. According to Arago & Nieto (2005), the analysis of volume and price changes relations has several limitations since total volume does not decrease the persistence of volatility. Frequency is a better proxy than volume. Volatility is also inversely related to the duration between trades (Purwono, Ekaputra, & Husodo, 2018).

Trade behavior models of informed market participants consist of a competitive transaction model and a strategic transaction model (Easley et al., 1997). In the competitive transaction model, the informed market participants tend to conduct high-value transactions with lower frequency. On the other hand, in the strategic transaction model, the informed traders transact in increasing transaction frequency with a low average trade size (Easley et al., 1997). Informed traders with similar opinions will tend to conduct competitive transactions, while informed traders with different opinions tend to conduct strategic transactions (Jones et al., 1994).

3. METHODOLOGY

3.1. Data

We obtain daily data from Thomson Reuters Datastream. The data consists of the stock closing price, trade frequency (number of trades), transaction volume. The Indonesia Stock Exchange (IDX) is the proxy for mixed-market, and the Saudi Stock Exchange (Tadawul) is the proxy of the Islamic market. The observation period is from April 11th, 2011, to October 31st, 2017.

To select the sample, we first select all sharia-compliant stocks from the IDX that are consistently in the Indonesia Sharia Stock Index (ISSI) during 2011- 2017, and we find 62 eligible stocks. Secondly, we randomly select 50 stocks from Tadawul. Although we do not perform sector analysis, thirdly, we identify the sector of each stock in the sample.

3.2. Methodology

We use the GARCH model to analyze the volume and frequency relationship with return volatility. Specifically, we analyze the volatility persistence before and after the absorption of volume and frequency into the conditional variance. Eq. (1) describes the assumptions of characteristics of information that enter into the capital market (Clark, 1973):

$$y_t = \sum_{i=1}^{nt} \delta_{it} \qquad y_t | n_t \sim N(0, \sigma^2 n_t). \tag{1}$$

If δ_{it} is assumed iid (independently and identically distributed) with a mean rate of zero and a constant variance, then δ_{it} is the information of an occurring event (Pyun et al., 2000). Whereas n_t represents the amount of information entering the market at time-t. Thus, the increase of n_t, which

is the stochastic mixing variable, will stimulate a higher amount of information (δ_{it}) entering into the market (Pyun et al., 2000). Thus, the higher amount and more substantial information (δ_{it}) will affect stock price changes (y_t). Therefore, the volume of transactions or frequency can be used as a proxy to determine the amount of information entering the capital market (Pyun et al., 2000). To model the mean of the daily return process, we follow Chan & Fong (2000) and Jones et al., (1994) as presented in Eq. (2).

$$r_{it} = \sum_{k=1}^{5} \propto_{ik} D_{kt} + \sum_{j=1}^{12} \beta_j \, r_{it-j} + \epsilon_{it} \quad (2)$$

r_{it} is the return of stock-i in a period-t, while D_{kt} represents five days per week to distinguish the average rate of return. Twelve lagged returns are used to estimate the rate of short-term change in the conditional expected return. GARCH model without the absorption of volume into conditional variance equation is in Eq.(3) (Bollerslev, 1986):

$$r_t = \beta r_{t-1} + \varepsilon_t, \text{ which } \varepsilon_t | \Omega_{t-1} \sim N(0, h_t) \quad (3)$$
$$ht = c_0 + \sum_{i=1}^{q} \alpha_1 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_2 h_{t-j}$$

GARCH model that absorbs the volume into the conditional variance equation is in Eq. (4) (Pyun et al., 2000):

$$r_t = \beta r_{t-1} + \varepsilon_t, \text{ which } \varepsilon_t | \Omega_{t-1} \sim N(0, h_t) \quad (4)$$
$$ht = c_0 + \sum_{i=1}^{q} \alpha_3 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_4 h_{t-j} + \gamma_5 V_t$$

GARCH model that absorbs the frequency (number of trades) into conditional variance is Eq. (5):

$$r_t = \beta r_{t-1} + \varepsilon_t, \text{ which } \varepsilon_t | \Omega_{t-1} \sim N(0, h_t) \quad (5)$$
$$ht = c_0 + \sum_{i=1}^{q} \alpha_6 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_7 h_{t-j} + \gamma_8 F_t$$

- r_t = return on the period-t
- r_{t-1} = return on the period-t-1
- ht = volatility on the period-t
- c_0 = constants
- $\alpha_6 \varepsilon_{t-1}^2$ = ARCH term
- $\beta_7 h_{t-j}$ = GARCH term
- $\gamma_5 V_t$ = absorbed Volume in period-t
- $\gamma_8 F_t$ = absorbed Frequency in period-t

We analyze the results based on the following formulations (Pyun et al., 2000):

1. The relationship between volume and return volatility:
   - If volatility persistence $\alpha_3+\beta_4$ decreases, then the information distribution process is consistent with the assumption of MDH.
   - If the volatility persistence $\alpha_3+\beta_4$ does not decrease, then the information distribution process is consistent with SIAH's assumption.

2. The relationship between trade frequency (number of trades) and return volatility:
   - If volatility persistence $\alpha_6+\beta_7$ decreases, then the information distribution process is consistent with the assumption of MDH.
   - If volatility persistence $\alpha_6+\beta_7$ does not decrease, then the information distribution process is consistent with SIAH's assumption.

We use the Wald Test to examine the behavior of informed market participants. Wald Test is a modality that is used to test the significance level of correlation between the coefficient of independent variables and the dependent variables. Wald test hypothesis is constructed in the following (Ratsimalahelo, 2005):

$$H_0 = g(\theta) = 0$$
$$H_1 = g(\theta) \neq 0$$

H_0 represents that there is no correlation between independent variables and dependent variables. Meanwhile, H_1 represents that there is a correlation between independent variables and dependent variables.

4. RESULTS AND DISCUSSION

4.1. Information Distribution Process in Indonesia

We use Augmented Dickey-Fuller in order to test the sample of unit root test of return, volume, and frequency of sharia-compliant companies in Indonesia and Saudi Arabia. The result of the ADF test shows that all variables do not have unit-roots. Therefore, the testing of the process of information distribution will be valid. Sharia-compliant companies in Indonesia generally have very high volatility of returns. The average level of return volatility persistence without absorption of volume and frequency is 0.90270. The highest level of return volatility persistence in Indonesia's sharia-compliant stocks is: AIMS (1.01713), EKAD (1.00820), SRSN (1.03053), KIJA (1.00898). Stocks with the lowest level of volatility persistence include EPMT (0.58961) and JRPT (0.69183).

When the volume is absorbed in the variance process, the average volatility persistence decreases to 0.61194. The highest volatility persistence is SRSN (0.74750), while the lowest volatility persistence is LION (0.52959). After the frequency is absorbed, the average level of volatility persistence decreases to 0.61897. The highest volatility persistence is SRSN (0.75303), while the lowest volatility persistence is KAEF (0.50014).

If there is no decrease in volatility persistence, then it is inconsistent with the assumption of MDH, because there is high and unusual volume. The cause of unusual volume is unpublicized information or big shock event. Therefore, unusual volume indicates the presence of very strong information (Omran & McKenzie, 2000). Non-declining or stable volatility persistence indicates that there is a difference in the process of information distribution, the behavior of market participants, the reactions or perspectives of market participants' opinions on information (Bose & Rahman, 2015).

We identify 58 sharia-compliant companies in Indonesia that follow the assumption of MDH in the process of distribution of information. The decrease of volatility persistence that occurs after the absorption of frequency and volume is following MDH assumptions. According to the MDH assumption, the market participants simultaneously obtain the information, which is hard to observe and non-random in their nature (Clark, 1973). Companies with MDH assumptions indicate that the relationship between volume and price changes are contemporaneous (Clark, 1973). Volumes that are unable to predict the price changes indicate the inability of market participants to obtain an abnormal return. The MDH process in the capital market is following the Efficient Market Hypothesis.

We observe four companies under the SIAH assumption in the process of distribution of information: VOKS, ACES, LION, and EPMT. These four stocks are small caps with low liquidity and price efficiency (Ekaputra & Asikin, 2012). According to the SIAH assumption, market participants obtain information in random and in non-continuous fashion (Copeland, 1976). According to Copeland (1976), in SIAH, the price equilibrium changes sequentially from initial equilibrium to final equilibrium. The final equilibrium occurs when the market participants have the same opinion on the information. The information that is unable to create shocks in the market will decrease the volatility. Therefore, the presence of new information entering the market will re-change the final equilibrium into the initial equilibrium. Hence, the process of information distribution occurs sequentially. The SIAH process reflects an inefficient capital market due to the non-simultaneous distribution of information.

Table 1: Volatility persistence of sharia-compliant stocks in Indonesia, before and after volume and frequency absorption in the conditional variance process

Model 1. Before volume and frequency is absorbed in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_1 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_2 h_{t-j}$$

Model 2: After volume is absorbed in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_3 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_4 h_{t-j} + \gamma_5 V_t$$

Model 3: After frequency is absorbed in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_6 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_7 h_{t-j} + \gamma_8 F_t$$

Sector	α_1	β_2	$\alpha_1 + \beta_2$	α_3	β_4	γ_5	$\alpha_3 + \beta_4$	α_6	β_7	γ_8	$\alpha_6 + \beta_7$
Automotive and Components Sector											
ASII	0.05***	0.93***	0.98	0.12***	0.52***	0.00***	0.64	0.12***	0.53***	0.00***	0.65
SMSM	0.10***	0.79***	0.89	0.12***	0.53***	0.00***	0.64	0.12***	0.54***	0.00***	0.66
Chemical Sector											
APLI	0.29***	0.44***	0.73	0.20***	0.46***	0.00***	0.66	0.11***	0.45***	0.00***	0.56
BRAM	0.06***	0.92***	0.98	0.13***	0.49***	0.00***	0.62	0.13***	0.48***	0.00***	0.61
DPNS	0.18***	0.53***	0.71	0.10***	0.47***	0.00***	0.58	0.11***	0.47***	0.00***	0.58
EKAD	0.07***	0.93***	1.01	0.14***	0.52***	0.00***	0.66	0.14***	0.51***	0.00***	0.66
INCI	0.16***	0.63***	0.80	0.11***	0.50***	0.00***	0.61	0.11***	0.50***	0.00***	0.62
SRSN	0.25***	0.78***	1.03	0.15***	0.60***	0.00***	0.75	0.16***	0.60***	0.00***	0.75
TRST	0.12***	0.86***	0.98	0.09***	0.48***	0.00***	0.57	0.11***	0.50***	0.00***	0.61
Material Construction Sector											
ARNA	0.12***	0.78***	0.90	0.10***	0.49***	0.00***	0.59	0.10***	0.50***	0.00***	0.60
INTP	0.11***	0.81***	0.92	0.10***	0.50***	0.00***	0.60	0.11***	0.51***	0.00***	0.62
TOTL	0.06***	0.93***	0.99	0.09***	0.51***	0.00***	0.60	0.10***	0.50***	0.00***	0.60
TOTO	0.07***	0.89***	0.96	0.14***	0.57***	0.00***	0.71	0.14***	0.56***	0.00***	0.70
WIKA	0.15***	0.69***	0.84	0.10***	0.50***	0.00***	0.60	0.10***	0.51***	0.00***	0.61
Electronics Sector											
KBLM	0.05***	0.95***	1.00	0.12***	0.47***	0.00***	0.59	0.11***	0.48***	0.00***	0.59
KBLI	0.10***	0.83***	0.93	0.10***	0.50***	0.00***	0.60	0.10***	0.50***	0.00***	0.60
VOKS	0.18***	0.37***	0.55	0.13***	0.54***	0.00***	0.67	0.13***	0.54***	0.00***	0.67
PTSN	0.23***	0.53***	0.76	0.11***	0.45***	0.00***	0.56	0.11***	0.45***	0.00***	0.56
Food and Drug Sector											
AIMS	0.09***	0.93***	1.02	0.16***	0.51***	0.00***	0.67	0.14***	0.49***	0.00***	0.63
MBTO	0.07***	0.92***	0.99	0.11***	0.50***	0.00***	0.61	0.12***	0.51***	0.00***	0.63
Food Producing Sector											
AALI	0.14***	0.83***	0.97	0.13***	0.48***	0.00***	0.61	0.13***	0.51***	0.00***	0.64
CPIN	0.12***	0.85***	0.97	0.14***	0.47***	0.00***	0.61	0.15***	0.48***	0.00***	0.62
IIKP	0.09***	0.89***	0.98	0.14***	0.53***	0.00***	0.67	0.11***	0.47***	0.00***	0.58
SGRO	0.16***	0.81***	0.97	0.13***	0.54***	0.00***	0.67	0.13***	0.55***	0.00***	0.68
Retail Trade Sector (Retail)											
ACES	0.22***	0.35***	0.57	0.09***	0.49***	0.00***	0.58	0.09***	0.49***	0.00***	0.58
MLPL	0.18***	0.75***	0.93	0.08***	0.50***	0.00***	0.58	0.08***	0.49***	0.00***	0.58
MPPA	0.03***	0.96***	0.99	0.06***	0.51***	0.00***	0.57	0.07***	0.51***	0.00***	0.58
Home and Construction Equipment Sector											
KDSI	0.05***	0.92***	0.97	0.08***	0.49***	0.00***	0.57	0.09***	0.49***	0.00***	0.57
LMPI	0.17***	0.65***	0.82	0.16***	0.43***	0.00***	0.59	0.16***	0.47***	0.00***	0.63
SSIA	0.06***	0.92***	0.98	0.11***	0.49***	0.00***	0.60	0.11***	0.48***	0.00***	0.59
Metal and Mineral Industry Sector											
BTON	0.06***	0.92***	0.98	0.08***	0.51***	0.00***	0.59	0.09***	0.51***	0.00***	0.60
GDST	0.14***	0.78***	0.92	0.13***	0.55***	0.00***	0.69	0.14***	0.56***	0.00***	0.69
JPRS	0.26***	0.58***	0.85	0.13***	0.54***	0.00***	0.68	0.14***	0.55***	0.00***	0.69
LION	0.19***	0.52***	0.71	0.14***	0.39***	0.00***	0.53	0.14***	0.56***	0.00***	0.70

Model 1. Before volume and frequency is absorbed in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_1 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_2 h_{t-j}$$

Model 2: After volume is absorbed in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_3 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_4 h_{t-j} + \gamma_5 V_t$$

Model 3: After frequency is absorbed in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_6 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_7 h_{t-j} + \gamma_8 F_t$$

Sector	α_1	β_2	$\alpha_1 + \beta_2$	α_3	β_4	γ_5	$\alpha_3 + \beta_4$	α_6	β_7	γ_8	$\alpha_6 + \beta_7$
Real Estate Sector											
APLN	0.11***	0.72***	0.83	0.11***	0.52***	0.00***	0.63	0.11***	0.52***	0.00***	0.63
ASRI	0.08***	0.87***	0.95	0.11***	0.49***	0.00***	0.60	0.11***	0.49***	0.00***	0.60
BKSL	0.09***	0.87***	0.96	0.07**	0.50***	0.00***	0.57	0.07***	0.50***	0.00***	0.57
BSDE	0.14***	0.78***	0.92	0.07***	0.48***	0.00***	0.55	0.09***	0.49***	0.00***	0.58
CTRA	0.05***	0.93***	0.98	0.07***	0.48***	0.00***	0.55	0.08***	0.48***	0.00***	0.56
DILD	0.18***	0.79***	0.96	0.13***	0.49***	0.00***	0.62	0.13***	0.50***	0.00***	0.63
GPRA	0.19***	0.66***	0.85	0.08***	0.50***	0.00***	0.58	0.05***	0.48***	0.00***	0.54
JRPT	0.17***	0.52***	0.69	0.14***	0.56***	0.00***	0.70	0.14***	0.57***	0.00***	0.71
KIJA	0.08***	0.92***	1.01	0.14***	0.51***	0.00***	0.65	0.14***	0.51***	0.00***	0.65
LPKR	0.05***	0.88***	0.93	0.11***	0.52***	0.00***	0.62	0.11***	0.52***	0.00***	0.64
PWON	0.10***	0.76***	0.86	0.09***	0.50***	0.00***	0.58	0.05***	0.48***	0.00***	0.53
SMRA	0.10***	0.82***	0.92	0.08***	0.47***	0.00***	0.55	0.08***	0.48***	0.00***	0.56
Cosmetics and Household Utilities sector											
INDR	0.21***	0.45***	0.65	0.10***	0.48***	0.00***	0.58	0.10***	0.47***	0.00***	0.57
MICE	0.10***	0.89***	0.99	0.14***	0.49***	0.00***	0.63	0.15***	0.57***	0.00***	0.72
RICY	0.18***	0.78***	0.96	0.14***	0.56***	0.00***	0.70	0.14***	0.57***	0.00***	0.71
TCID	0.13***	0.68***	0.81	0.00***	0.56***	0.00***	0.56	0.14***	0.58***	0.00***	0.72
UNVR	0.083***	0.87***	0.95	0.12***	0.52***	0.00***	0.64	0.13***	0.53***	0.00***	0.66
Coal Mining Sector											
ADRO	0.07***	0.91***	0.98	0.10***	0.48***	0.00***	0.59	0.11***	0.50***	0.00***	0.61
HRUM	0.04***	0.94***	0.98	0.09***	0.52***	0.00***	0.61	0.10***	0.51***	0.00***	0.61
ITMG	0.05***	0.93***	0.98	0.09***	0.49***	0.00***	0.58	0.10***	0.50***	0.00***	0.61
TINS	0.09***	0.88***	0.97	0.10***	0.49***	0.00***	0.59	0.11***	0.50***	0.00***	0.61
Pharmaceutical and Biotechnology Sector											
DVLA	0.29***	0.61***	0.91	0.15***	0.57***	0.00***	0.72	0.15***	0.59***	0.00***	0.74
EPMT	0.21***	0.38***	0.59	0.13***	0.53***	0.00***	0.66	0.10***	0.49***	0.00***	0.59
KAEF	0.11***	0.74***	0.85	0.07***	0.51***	0.00***	0.58	0.01***	0.49***	0.00***	0.50
TSPC	0.05***	0.94***	0.99	0.13***	0.54***	0.00***	0.68	0.14***	0.55***	0.00***	0.69
Tourism Sector											
FAST	0.14***	0.73***	0.87	0.13***	0.51***	0.00***	0.64	0.13***	0.52***	0.00***	0.65
BAYU	0.07***	0.89***	0.96	0.17***	0.45***	0.00***	0.62	0.16***	0.44***	0.00***	0.61

*significant at 10%, **significant at 5%, ***significant at 1%. Highlighted numbers show an increase in volatility persistence after the absorption of volume or frequency in the conditional variance process.

4.2. Informed Trading in Indonesia

Informed trading in Indonesia follows two characteristics: a competitive transaction model and a strategic transaction model. However, we learn that informed trading in most stocks (59 stocks or 95%) follow competitive transaction behavior, while only three companies (5%) follow strategic behavior. Asymmetric information (SIAH) with a competitive transaction model indicates the presence of informed traders that compete with each other (Jones et al., 1994). Also, informed traders that conduct a competitive transaction behavior indicates that informed traders have the same perspectives on the market (Jones et al., 1994). In LQ-45 companies, with high market capitalization, the frequency is dominant, indicating a strategic transaction behavior (Ekaputra, 2014).

Table 2: Informed trading behavior in Indonesian market

Model 2: After volume is included in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_3 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_4 h_{t-j} + \gamma_5 V_t$$

Model 3: After frequency is included in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_6 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_7 h_{t-j} + \gamma_8 F_t$$

Sector	Wald Test Model 2 (γ_5)			Wald Test Model 3 (γ_8)		
	Coeficient Value	Standard Deviation	Prob	Coeficient Value	Standard Deviation	Prob
Automotive and Components Sector						
ASII	0.00002320	0.00000115	10^{-2}	0.00001790	0.00000095	10^{-2}
SMSM	0.00002630	0.00000097	10^{-2}	0.00003200	0.00000061	10^{-2}
Chemical Sector						
BRAM	0.00034400	0.00001440	10^{-2}	0.00017800	0.00000668	10^{-2}
TRST	0.00007290	0.00000235	10^{-2}	0.00006140	0.00000270	10^{-2}
EKAD	0.00007770	0.00000220	10^{-2}	0.00005640	0.00000207	10^{-2}
SRSN	0.00001470	0.00000084	10^{-2}	0.00000684	0.00000020	10^{-2}
DPNS	0.00018800	0.00000631	10^{-2}	0.00011300	0.00000422	10^{-2}
APLI	0.00009670	0.00000289	10^{-2}	0.00009680	0.00000222	10^{-2}
INCI	0.00007140	0.00000242	10^{-2}	0.00005200	0.00000178	10^{-2}
Material Construction Sector						
INTP	0.00003860	0.00000140	10^{-2}	0.00002690	0.00000095	10^{-2}
WIKA	0.00004630	0.00000148	10^{-2}	0.00003770	0.00000120	10^{-2}
TOTO	0.00003610	0.00000124	10^{-2}	0.00003550	0.00000119	10^{-2}
ARNA	0.00006000	0.00000276	10^{-2}	0.00005030	0.00000169	10^{-2}
TOTL	0.00006420	0.00000279	10^{-2}	0.00004860	0.00000188	10^{-2}
Electronics Sector						
VOKS	0.00010700	0.00000347	10^{-2}	0.00008650	0.00000283	10^{-2}
KBLI	0.00008560	0.00000295	10^{-2}	0.00006910	0.00000242	10^{-2}
KBLM	0.00014600	0.00000466	10^{-2}	0.00010500	0.00000374	10^{-2}
PTSN	0.00022900	0.00001190	10^{-2}	0.00017000	0.00000575	10^{-2}
Food and Drug Sector						
MBTO	0.00005270	0.00000191	10^{-2}	0.00004380	0.00000172	10^{-2}
AIMS	0.00035100	0.00001100	10^{-2}	0.00021700	0.00000629	10^{-2}
Food Producing Sector						
CPIN	0.00004210	0.00000203	10^{-2}	0.00003080	0.00000157	10^{-2}
AALI	0.00002080	0.00000087	10^{-2}	0.00002100	0.00000115	10^{-2}

Model 2: After volume is included in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_3 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_4 h_{t-j} + \gamma_5 V_t$$

Model 3: After frequency is included in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_6 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_7 h_{t-j} + \gamma_8 F_t$$

Sector	Wald Test Model 2 (γ_5)			Wald Test Model 3 (γ_8)		
	Coeficient Value	Standard Deviation	Prob	Coeficient Value	Standard Deviation	Prob
IIKP	0.00017200	0.00000581	10^{-2}	0.00015200	0.00000694	10^{-2}
SGRO	0.00002450	0.00000101	10^{-2}	0.00001770	0.00000009	10^{-2}
Retail Trade Sector (Retail)						
ACES	0.00003620	0.00000253	10^{-2}	0.00003090	0.00000137	10^{-2}
MPPA	0.00006150	0.00000169	10^{-2}	0.00004940	0.00000131	10^{-2}
MLPL	0.00009250	0.00000295	10^{-2}	0.00007290	0.00000221	10^{-2}
Home and Construction Equipment Sector						
SSIA	0.00006120	0.00000255	10^{-2}	0.00004790	0.00000186	10^{-2}
LMPI	0.00010500	0.00000239	10^{-2}	0.00009960	0.00000262	10^{-2}
KDSI	0.00014000	0.00000462	10^{-2}	0.00009870	0.00000381	10^{-2}
Metal and Mineral Industry Sector						
GDST	0.00009140	0.00000519	10^{-2}	0.00007490	0.00000222	10^{-2}
LION	0.00006780	0.00000136	10^{-2}	0.00005660	0.00000555	10^{-2}
JPRS	0.00009070	0.00000295	10^{-2}	0.00007030	0.00000225	10^{-2}
BTON	0.00011800	0.00000391	10^{-2}	0.00009610	0.00000337	10^{-2}
Real Estate Sector						
BSDE	0.00003070	0.00000006	10^{-2}	0.00002530	0.00000097	10^{-2}
LPKR	0.00003040	0.00000006	10^{-2}	0.00002540	0.00000110	10^{-2}
PWON	0.00004170	0.00000188	10^{-2}	0.00002730	0.00000097	10^{-2}
CTRA	0.00004680	0.00000027	10^{-2}	0.00003700	0.00000166	10^{-2}
SMRA	0.00003960	0.00000055	10^{-2}	0.00003060	0.00000135	10^{-2}
JRPT	0.00003410	0.00000091	10^{-2}	0.00002650	0.00000076	10^{-2}
ASRI	0.00004520	0.00000179	10^{-2}	0.00003660	0.00000025	10^{-2}
APLN	0.00004120	0.00000193	10^{-2}	0.00003310	0.00000132	10^{-2}
BKSL	0.00007270	0.00000247	10^{-2}	0.00006300	0.00000200	10^{-2}
KIJA	0.00004280	0.00000160	10^{-2}	0.00003460	0.00000120	10^{-2}
DILD	0.00004450	0.00000209	10^{-2}	0.00003520	0.00000184	10^{-2}
GPRA	0.00011900	0.00000479	10^{-2}	0.00009120	0.00000294	10^{-2}
Cosmetics and Household Utilities sector						
UNVR	0.00002920	0.00000103	10^{-2}	0.00001900	0.00000033	10^{-2}
TCID	0.00004200	0.00000102	10^{-2}	0.00002930	0.00000092	10^{-2}
INDR	0.00015500	0.00000584	10^{-2}	0.00011600	0.00000421	10^{-2}
MICE	0.00007020	0.00000239	10^{-2}	0.00006040	0.00000197	10^{-2}
RICY	0.00005660	0.00000169	10^{-2}	0.00004570	0.00000138	10^{-2}
Coal Mining Sector						
ADRO	0.00004240	0.00000169	10^{-2}	0.00003420	0.00000127	10^{-2}
ITMG	0.00004680	0.00000200	10^{-2}	0.00003090	0.00000131	10^{-2}
HRUM	0.00006390	0.00000200	10^{-2}	0.00004680	0.00000146	10^{-2}
TINS	0.00003920	0.00000157	10^{-2}	0.00003110	0.00000125	10^{-2}
Pharmaceutical and Biotechnology Sector						
TSPC	0.00003180	0.00000137	10^{-2}	0.00002190	0.00000061	10^{-2}
EPMT	0.00006180	0.00000032	10^{-2}	0.00002250	0.00000025	10^{-2}
KAEF	0.00009640	0.00000347	10^{-2}	0.00005830	0.00000129	10^{-2}
DVLA	0.00006930	0.00000326	10^{-2}	0.00004210	0.00000208	10^{-2}

Model 2: After volume is included in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_3 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_4 h_{t-j} + \gamma_5 V_t$$

Model 3: After frequency is included in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_6 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_7 h_{t-j} + \gamma_8 F_t$$

Sector	Wald Test Model 2 (γ_5)			Wald Test Model 3 (γ_8)		
	Coeficient Value	Standard Deviation	Prob	Coeficient Value	Standard Deviation	Prob
Tourism Sector						
FAST	0.00006080	0.00000343	10^{-2}	0.00004280	0.00000172	10^{-2}
BAYU	0.00006810	0.00000130	10^{-2}	0.00005430	0.00000214	10^{-2}

Null Hypotesis: $\gamma_5 = 0$, or $\gamma_8 = 0$. If $\gamma_5 > \gamma_8$ then it indicates informed trading competitive transactions model. If $\gamma_5 < \gamma_8$ then it indicates informed trading strategic transaction model. Highlighted numbers show the higher value between the two coefficients.

4.3. Information Distribution Process in Saudi Arabia

In the Saudi Arabian market, social and environmental factors rather than fundamental information tend to affect volatility due to the interaction between corporate culture, social norms, and strong religious ideology in the sharia capital market (Canepa & Ibnrubbian, 2014). The level of volatility persistence before the absorption of volume and frequency into conditional variance is considered high. The highest volatility persistence is 1.00286 (AJC), and the lowest level of volatility persistence is 0.70445 (ALK). The average volatility persistence in Saudi is 0.89897, which is lower than in Indonesia (0.90270).

Like the Indonesian market, the volatility persistence decreases after the absorption of volume and frequency into the conditional variance. The highest level of volatility persistence after the absorption of the volume is 0.97386 (SII), while the lowest level is 0.54758 (SIE). The highest volatility persistence level after the absorption of frequency is 0.74365 (AJC), while the lowest level is 0.51919 (AGD).

The decrease of volatility persistence after the absorption of volume and frequency can indicate that the information distribution process is following MDH (Pyun et al., 2000). Similar to the Indonesian market, we find 48 (96%) of sharia-compliant stocks in the Saudi Arabian market follow the MDH information distribution process. Since most of the stocks follow MDH, which means the relations between volume-frequency and price changes occur simultaneously (Clark, 1973), we may conclude that the Saudi Arabian market is informationally efficient. In other words, market participants are almost impossible to obtain abnormal returns using historical volume, frequency, and return data.

The stable or non-decreasing volatility persistence after the absorption of volume and frequency indicates that stocks follow the SIAH information distribution process (Darrat et al., 2003). There are only 2 (4%) companies (SII and QAC) that are under SIAH assumptions. The SIAH information distribution process indicates that the relationship between price and volume changes occurs in lagged series (Copeland, 1976). Hence, volume and price changes in the previous period and the next period will correlate to each other. In other words, the SIAH process indicates an informationally-inefficient market. Market participants may obtain abnormal returns based on historical volume and price data.

Table 3: Volatility persistence of sharia-compliant stocks in Saudi Arabia, before and after volume and frequency absorption in the conditional variance process

Model 1. Before volume and frequency is absorbed in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_1 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_2 h_{t-j}$$

Model 2: After volume is absorbed in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_3 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_4 h_{t-j} + \gamma_5 V_t$$

Model 3: After frequency is absorbed in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_6 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_7 h_{t-j} + \gamma_8 F_t$$

Sector	α_1	β_2	$\alpha_1 + \beta_2$	α_3	β_4	γ_5	$\alpha_3 + \beta_4$	α_6	β_7	γ_8	$\alpha_6 + \beta_7$
Chemical Sector											
SAF	0.25***	0.65***	0.90	0.14***	0.57***	0.00***	0.71	0.14***	0.57***	0.00***	0.71
CCC	0.07***	0.90***	0.97	0.19***	0.54***	0.00***	0.73	0.14***	0.53***	0.00***	0.67
NAC	0.17***	0.75***	0.92	0.20***	0.41***	0.00***	0.61	0.12***	0.48***	0.00***	0.0
NIC	0.11***	0.81***	0.92	0.13***	0.53***	0.00***	0.65	0.12***	0.52***	0.00***	0.65
SII	0.07***	0.90***	0.97	0.06***	0.91***	0.00***	0.97	0.11***	0.47***	0.00***	0.58
SPL	0.13***	0.80***	0.93	0.12***	0.76***	0.00***	0.88	0.13***	0.53***	0.00***	0.66
YNP	0.08***	0.89***	0.97	0.13***	0.52***	0.00***	0.65	0.13***	0.51***	0.00***	0.65
SIP	0.04***	0.96***	1.00	0.13***	0.52***	0.00***	0.64	0.16***	0.51***	0.00***	0.67
APP	0.13***	0.82***	0.96	0.13***	0.54***	0.00***	0.67	0.13***	0.53***	0.00***	0.66
SAK	0.15***	0.76***	0.91	0.13***	0.52***	0.00***	0.65	0.12***	0.51***	0.00***	0.64
BCI	0.11***	0.83***	0.94	0.13***	0.50***	0.00***	0.63	0.13***	0.50***	0.00***	0.63
Material Construction Sector											
NGC	0.14***	0.78***	0.93	0.13***	0.52***	0.00***	0.65	0.13***	0.52***	0.00***	0.64
SAA	0.15***	0.78***	0.93	0.13***	0.54***	0.00***	0.67	0.13***	0.54***	0.00***	0.67
ZII	0.10***	0.84***	0.94	0.13***	0.53***	0.00***	0.66	0.13***	0.53***	0.00***	0.66
SRC	0.19***	0.69***	0.88	0.14***	0.54***	0.00***	0.68	0.13***	0.52***	0.00***	0.64
ALA	0.19***	0.69***	0.88	0.13***	0.50***	0.00***	0.63	0.13***	0.50***	0.00***	0.63
SAU	0.13***	0.62***	0.75	0.12***	0.53***	0.00***	0.65	0.12***	0.53***	0.00***	0.66
AJC	0.13***	0.88***	1.00	0.15***	0.59***	0.00***	0.74	0.15***	0.59***	0.00***	0.74
ALO	0.28***	0.49***	0.77	0.12***	0.50***	0.00***	0.61	0.12***	0.50***	0.00***	0.61
Food Producing Sector											
FPC	0.22***	0.49***	0.72	0.10***	0.49***	0.00***	0.59	0.10***	0.49***	0.00***	0.58
NAD	0.20***	0.63***	0.83	0.13***	0.51***	0.00***	0.65	0.13***	0.51***	0.00***	0.64
JAD	0.15***	0.75***	0.90	0.13***	0.53***	0.00***	0.67	0.13***	0.53***	0.00***	0.67
AGD	0.20***	0.69***	0.89	0.11***	0.46***	0.00***	0.58	0.22***	0.30***	0.00***	0.52
TAD	0.14***	0.76***	0.89	0.10***	0.50***	0.00***	0.60	0.10***	0.50***	0.00***	0.60
QAC	0.18***	0.69***	0.87	0.15***	0.72***	0.00***	0.87	0.12***	0.50***	0.00***	0.62
Retail Trade Sector (Retail)											
SAS	0.17***	0.71***	0.88	0.11***	0.48***	0.00***	0.59	0.12***	0.50***	0.00***	0.62
JMC	0.09***	0.88***	0.97	0.14***	0.56***	0.00***	0.70	0.14***	0.56***	0.00***	0.70
APT	0.19***	0.61***	0.79	0.13***	0.53***	0.00***	0.67	0.13***	0.53***	0.00***	0.66
ALH	0.09***	0.85***	0.94	0.10***	0.48***	0.00***	0.58	0.10***	0.48***	0.00***	0.58
ALK	0.20***	0.50***	0.70	0.10***	0.49***	0.00***	0.59	0.10***	0.49***	0.00***	0.59
Household Utilities sector											
SPM	0.19***	0.73***	0.92	0.18***	0.49***	0.00***	0.67	0.23***	0.50***	0.00***	0.73
ALU	0.13***	0.80***	0.93	0.14***	0.53***	0.00***	0.66	0.14***	0.53***	0.00***	0.66
Mineral and Metal Industry											
NMC	0.12***	0.87***	0.98	0.16***	0.50***	0.00***	0.65	0.10***	0.51***	0.00***	0.61
APC	0.09***	0.87***	0.95	0.11***	0.50***	0.00***	0.61	0.11***	0.50***	0.00***	0.60
SSP	0.26***	0.48***	0.74	0.12***	0.49***	0.00***	0.61	0.11***	0.49***	0.00***	0.60
Oil and Gas Mining Sector											

Model 1. Before volume and frequency is absorbed in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_1 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_2 h_{t-j}$$

Model 2: After volume is absorbed in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_3 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_4 h_{t-j} + \gamma_5 V_t$$

Model 3: After frequency is absorbed in the conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_6 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_7 h_{t-j} + \gamma_8 F_t$$

Sector	α_1	β_2	$\alpha_1 + \beta_2$	α_3	β_4	γ_5	$\alpha_3 + \beta_4$	α_6	β_7	γ_8	$\alpha_6 + \beta_7$
SAR	0.15***	0.71***	0.86	0.11***	0.51***	0.00***	0.61	0.11***	0.50***	0.00***	0.61
PET	0.20***	0.73***	0.93	0.12***	0.51***	0.00***	0.63	0.19***	0.46***	0.00***	0.65
Real Estate Sector											
ARR	0.14***	0.73***	0.87	0.13***	0.53***	0.00***	0.66	0.13***	0.52***	0.00***	0.66
SES	0.12***	0.82***	0.94	0.13***	0.51***	0.00***	0.64	0.13***	0.51***	0.00***	0.64
EMA	0.18***	0.68***	0.86	0.11***	0.50***	0.00***	0.62	0.11***	0.50***	0.00***	0.61
JAB	0.19***	0.73***	0.92	0.16***	0.52***	0.00***	0.69	0.19***	0.52***	0.00***	0.71
DAR	0.18***	0.71***	0.89	0.12***	0.51***	0.00***	0.63	0.12***	0.51***	0.00***	0.63
KEC	0.26***	0.57***	0.83	0.10***	0.48***	0.00***	0.58	0.11***	0.49***	0.00***	0.60
SHR	0.23***	0.67***	0.90	0.14***	0.53***	0.00***	0.66	0.14***	0.52***	0.00***	0.66
TAI	0.32***	0.63***	0.94	0.14***	0.54***	0.00***	0.69	0.14***	0.54***	0.00***	0.69
Services Sector											
SIE	0.13***	0.80***	0.93	0.09***	0.45***	0.00***	0.55	0.09***	0.49***	0.00***	0.57
SAP	0.16***	0.76***	0.91	0.11***	0.47***	0.00***	0.58	0.11***	0.47***	0.00***	0.58
Tourism Sector											
TEC	0.17***	0.73***	0.91	0.10***	0.47***	0.00***	0.57	0.10***	0.48***	0.00***	0.59
HFS	0.18***	0.56***	0.74	0.12***	0.51***	0.00***	0.63	0.12***	0.51***	0.00***	0.63
SPT	0.20***	0.75***	0.95	0.12***	0.49***	0.00***	0.61	0.12***	0.49***	0.00***	0.61

*significant at 10%, **significant at 5%, ***significant at 1%. Highlighted numbers show an increase in volatility persistence after the absorption of volume or frequency in the conditional variance process

4.4. Informed Trading in Saudi Arabia

In the Indonesian market, we find that informed market participants exhibit competitive transaction behavior in 95% of stocks, and exhibit strategic transaction behavior in only 5% of the stocks. In the Saudi Arabian market, we find the opposite where informed market participant exhibits competitive transaction behavior in only 38% of stocks and strategic transaction behavior in 62% of the stocks. These facts may indicate that the structure of social environments such as religion in the Islamic capital market influences the behavior of sharia market players (Canepa & Ibnrubbian, 2014). The volatility of the Saudi Arabian market is more affected by the behavior of investment rather than by information fundamentals. Hence, market participants in Saudi Arabia can be compared to noise traders with high-risk aversion without speculation. Substantial Islamic market capital with conservative market behavior can allow the market participants to trade in increasing frequency with the small trade size (Canepa & Ibnrubbian, 2014).

The characteristics of the information distribution and their effect on market participant behavior depend on several factors. These factors include the number of market participants, the number of informed traders that influence the price changes in the capital market, the capability of information to cause a shock event in the stock market, and the changing perspective of each market participant (Copeland, 1976). Informed traders typically perform a strategic transaction model in order to determine the reaction of uninformed traders and market conditions in the future (Hong & Rady, 2002). Once the informed traders evaluate the market conditions well, they will then initiate a strategic transaction model or a competitive transaction model (Hong & Rady, 2002). If the level of uninformed traders and the volume transactions are considered low, the large traders will lower the frequency of transactions and conduct the competitive transaction model (Hong & Rady, 2002).

Table 4: Informed trading behavior in the Saudi Arabian market

Model 2: After volume is arbsorbed into conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_3 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_4 h_{t-j} + \gamma_5 V_t$$

Model 3: After frequency is arbsorbed into conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_6 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_7 h_{t-j} + \gamma_8 F_t$$

Sektor	Wald Test Model 2 (γ_5)			Wald Test Model 3 (γ_8)		
	Coefficient Value	Standard Deviations	Prob	Coefficient Value	Standard Deviation	Prob
Chemical Sector						
SAF	0.00001690	0.00000066	0.00	0.00001730	0.00000068	0.00
YNP	0.00002790	0.00000060	0.00	0.00002860	0.00000129	0.00
SAK	0.00002840	0.00000101	0.00	0.00003310	0.00000115	0.00
NIC	0.00002870	0.00000102	0.00	0.00003140	0.00000010	0.00
SII	0.00001450	0.00000051	0.00	0.00002060	0.00000073	0.00
SIP	0.00002150	0.00000081	0.00	0.00001490	0.00000046	0.00
SPL	0.00000949	0.00000043	0.00	0.00002590	0.00000205	0.00
APP	0.00002920	0.00000026	0.00	0.00002850	0.00000129	0.00
CCC	0.00000975	0.00000023	0.00	0.00003100	0.00000126	0.00
NAC	0.00002970	0.00000081	0.00	0.00005710	0.00000238	0.00
BCI	0.00003560	0.00000160	0.00	0.00003530	0.00000113	0.00
Material Construction Sector						
SRC	0.00002560	0.00000121	0.00	0.00002370	0.00000088	0.00

Model 2: After volume is arbsorbed into conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_3 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_4 h_{t-j} + \gamma_5 V_t$$

Model 3: After frequency is arbsorbed into conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_6 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_7 h_{t-j} + \gamma_8 F_t$$

Sektor	Wald Test Model 2 (γ_5)			Wald Test Model 3 (γ_8)		
	Coefficient Value	Standard Deviations	Prob	Coefficient Value	Standard Deviation	Prob
ZII	0.00002520	0.00000098	0.00	0.00002510	0.00000100	0.00
AJC	0.00002110	0.00000072	0.00	0.00002220	0.00000043	0.00
SAA	0.00002830	0.00000123	0.00	0.00003130	0.00000137	0.00
ALO	0.00005340	0.00000212	0.00	0.00005480	0.00000208	0.00
ALA	0.00003660	0.00000126	0.00	0.00003720	0.00000153	0.00
SAU	0.00003330	0.00000149	0.00	0.00003130	0.00000137	0.00
NGC	0.00003370	0.00000118	0.00	0.00003430	0.00000116	0.00
Food Producing Sector						
NAD	0.00003140	0.00000039	0.00	0.00003220	0.00000132	0.00
JAD	0.00003410	0.00000163	0.00	0.00003410	0.00000062	0.00
QAC	0.00001760	0.00000059	0.00	0.00004980	0.00000193	0.00
TAD	0.00005100	0.00000181	0.00	0.00005240	0.00000180	0.00
FPC	0.00005990	0.00000219	0.00	0.00005920	0.00000230	0.00
AGD	0.00005630	0.00000194	0.00	0.00004240	0.00000152	0.00
Retail Trade Sector (Retail)						
JMC	0.00002280	0.00000087	0.00	0.00002200	0.00000086	0.00
ALH	0.00004230	0.00000180	0.00	0.00004100	0.00000197	0.00
APT	0.00002620	0.00000112	0.00	0.00002670	0.00000001	0.00
ALK	0.00005210	0.00000150	0.00	0.00005360	0.00000161	0.00
SAS	0.00004390	0.00000158	0.00	0.00004800	0.00000181	0.00
Household Utilities sector						
ALU	0.00002530	0.00000109	0.00	0.00002580	0.00000110	0.00
SPM	0.00002960	0.00000102	0.00	0.00002330	0.00000067	0.00
Metal and Mineral Industry Sector						
SSP	0.00003370	0.00000152	0.00	0.00003370	0.00000148	0.00
APC	0.00004080	0.00000147	0.00	0.00004270	0.00000145	0.00
NMC	0.00002630	0.00000066	0.00	0.00004780	0.00000175	0.00
Oil and Gas Mining Sector						
PET	0.00003740	0.00000173	0.00	0.00001870	0.00000054	0.00
SAR	0.00005420	0.00000227	0.00	0.00005200	0.00000210	0.00
Real Estate Sector						
JAB	0.00001750	0.00000102	0.00	0.00001580	0.00000042	0.00
EMA	0.00004060	0.00000145	0.00	0.00004340	0.00000162	0.00
DAR	0.00003520	0.00000140	0.00	0.00004010	0.00000165	0.00
KEC	0.00008970	0.00000409	0.00	0.00005100	0.00000239	0.00
TAI	0.00002850	0.00000128	0.00	0.00002860	0.00000120	0.00
SES	0.00003350	0.00000133	0.00	0.00003400	0.00000126	0.00
SHR	0.00003020	0.00000119	0.00	0.00002990	0.00000118	0.00
ARR	0.00002330	0.00000054	0.00	0.00002570	0.00000087	0.00
Services Sector						
SAP	0.00006580	0.00000278	0.00	0.00006570	0.00000275	0.00
SIE	0.00005820	0.00000217	0.00	0.00006110	0.00000115	0.00
Tourism Sector						
HFS	0.00002890	0.00000131	0.00	0.00002850	0.00000121	0.00

Model 2: After volume is arbsorbed into conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_3 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_4 h_{t-j} + \gamma_5 V_t$$

Model 3: After frequency is arbsorbed into conditional variance:

$$ht = c_0 + \sum_{i=1}^{q} \alpha_6 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_7 h_{t-j} + \gamma_8 F_t$$

Sektor	Wald Test Model 2 (γ_5)			Wald Test Model 3 (γ_8)		
	Coefficient Value	Standard Deviations	Prob	Coefficient Value	Standard Deviation	Prob
SPT	0.00003730	0.00000157	0.00	0.00003970	0.00000164	0.00
TEC	0.00005830	0.00000252	0.00	0.00005570	0.00000234	0.00

Null Hypotesis: $\gamma_5 = 0$, or $\gamma_8 = 0$. If $\gamma_5 > \gamma_8$, then it indicates an informed trading competitive transaction model. If $\gamma_5 < \gamma_8$, then it indicates an informed trading strategic transaction model. Highlighted numbers show a higher value between the two coefficients.

5. CONCLUSION

This study aims to compare the information distribution process and the behavior of informed traders in sharia-compliant stocks in two different markets: the mixed market vs. the Islamic market. Based on 62 sharia-compliant stocks in Indonesia (mixed market) and 50 sharia-compliant stocks in Saudi Arabia (Islamic market), we find the following. Firstly, in the Indonesian market, 58 (94%) companies follow the Mixture of Distribution Hypothesis (MDH) process, and four companies (6%) follow the Sequential Information Arrival Hypothesis (SIAH). Meanwhile, in the Saudi Arabian market, 48 companies (96%) follow the MDH, and 2 (4%) companies follow the SIAH. The MDH assumes that price changes occur randomly, and the price change has a contemporaneous correlation with the volume. Hence, the previous period of information cannot predict the period afterward (Clark, 1973). In contrast, the SIAH allows for the lagged series relationship between volume and price changes. The current volume can predict the next price change, and the current price change can also the next period volume (Copeland, 1976).

Secondly, informed traders in the Indonesian market tend to exhibit competitive transaction behavior in 59 (95%) stocks and strategic transaction behavior in only 3 (5%) stocks. On the contrary, informed traders in the Saudi Arabian market tend to exhibit competitive behavior in only 18 (38%) stocks and strategic behavior in 31 (62%) stocks. In the strategic transaction model, informed traders tend to increase transaction frequency with low average trade size. Conversely, in the competitive transactions model, the informed traders tend to transact in lower frequency with an increasing transaction value (Easley et al., 1997). Informed traders with similar opinions tend to follow a competitive transaction model, while informed traders with different opinions tend to follow the strategic transaction model (Jones et al., 1994). Additionally, the behavior of market participants is not only influenced by fundamental information but also by social structures, including religious structures (Canepa & Ibnrubbian, 2014).

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