

**The Ramadan Effects on the Economy:
Focused on the Volatility of Economic Variables of
Indonesia and Malaysia ***

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This paper examined the impact of Ramadan, which is one of the most popular and typical religious ceremony of Islam, on the macroeconomic variables, covering the real, financial, and external sector of the economy in a way of quantitative analysis. We investigated the cases for Indonesia and Malaysia because Islamization policy has been strengthened and Islamic factors and influences are spreading and reinforced pervasively among the people. Utilizing the GARCH model to estimate the volatility of the economic variables, we found that there are statistically significant changes or differences in the movement of economic variables around Ramadan period compared with the other ordinary period, especially for Indonesia. It is believed that the volatility of economic variables could get larger because people tend to rebalance or compensate for the reduction in economic activities during Ramadan. It could bring people into more excessive economic activities after Ramadan, which could be the main reason for the increase in the volatility of economic variables. It may support the hypothesis that the religion affects the economic decisions and behaviors of people.

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1. INTRODUCTION

Religion is an element of culture that pervades every aspect of a society. Religious beliefs could play a significant role in shaping social and economic behavior as well. The difference in religious beliefs and rituals may influence on the way people live and the choices they make. Accordingly it results in the differences of economic motivation and outcome. Therefore, we could say that the religious influence on the economic decisions and behaviors of people could not be underestimated and is worth to study.

Muslims consider Ramadan as the most important of the ritual duties of Islam. Even if a person does not comply with the requirement of five prayers a day, observance of the fast during Ramadan is still likely (Keenan and Yeni, 2003; Rippin, 1993). Ramadan reflects many aspects of Muslim people's life, such as culture, charity, consumption, and so on. It can be stated without doubt that Ramadan has significant effects on trade, economic, and financial variables in the daily life of Muslims. For example, product sales and product varieties go up during Ramadan. Particularly, sales of some items such as food and clothing might increase in Ramadan. On the other hand, Ramadan discourages economic activities in a sense that people retreat from daily and ordinary life style. The Koran prohibits such behavior like having sex, eating out in daytime and drinking alcohol. By religious customs individuals are to refrain from such practices during Ramadan. Thus, this may result in a reduction in economic activities that involve these practices and related items.

In this manner, this paper examines the impact of Ramadan, which is one of the most popular and typical religious ceremony of Islam, on the macroeconomic variables including real, financial, and external sectors. If we could find significant changes or differences in the movement of economic variables before and after Ramadan, it would imply that the religious ceremony may affect the economic decision-making of people. Based on the intuition, we assume that there would be a greater volatility of economic variables around Ramadan period. In other words, it is assumed

that people tend to compensate for and rebalance the shrinking and discouragement of the economic activities owing to the religious customs — here Ramadan. The shrinking of economic activities before or/and during Ramadan would bring people into the excessive economic activities after Ramadan, which may result in volatility increase in economic variables.

As Ramadan continues almost one month, we could examine whether any macroeconomic variable changes before and after Ramadan.¹⁾ Using the GARCH model to estimate the volatility of the economic variables, we see whether Ramadan influences on the volatility of economic variables (Kang and Yoon, 2011). The changes in the volatility of macroeconomic variables around Ramadan period could be the evidence that shows the strengthening of Islamization policy indeed affect the decision of the general economic players.

For the analysis, we investigate the case for Indonesia and Malaysia in Southeast Asia — Muslims are majority in both countries and Islamization policy supported by government has been strengthened and Islamic factors and elements have been spreading and reinforced pervasively among the people.²⁾ The analysis may provide us with a few evidences that a religious ritual activity — Ramadan could impose significant impacts on the economic decision making of people. This may imply that religion could influence on the macroeconomy. Furthermore, we examine whether the impact of Ramadan on the economic variables get strengthened with the passage of time. If Ramadan gets more influential it may indicate that the religious faith and/or activities of people get strengthened as well. Also, we include the comparative study to examine the difference between Ramadan and

¹⁾ See table A1 in Appendix 1 for the time schedule of Ramadan during 1990-2013.

²⁾ The origin of Islamization of two countries comes from the Islamic Revivalism (so called *dakwah* in Malay) in 1970s-1980s led by college students and some elite groups. The Islamic Revivalism has spread into the society as a whole after 1980s. For example, the policies to strengthen Islam and the Islamic regime — Islamic finance (banking, insurance, and bonds), halal certification in the food industry, Islamic medicine, Islamic education, Islamic Courts, and policies related to the Muslim media — has been adopted and implemented in Indonesia and Malaysia since the 1990s. The strengthening of religious evangelize is not just to stay in the area, but also seems to have a significant impact on economic decisions and behavior of economic agents.

Christmas & New Year holiday seasons. The results may provide implications for economic policy and marketing strategy for business in the countries whose Islamization progressed in a fast track.

This study consists of the following sections. The next chapter reviews the researches on the effects of Ramadan. Section 3 presents the model and data for or analysis. Section 4 performs the statistical analysis — GARCH estimation for Indonesia and Malaysia and interprets the results. Section 5 summarizes the points brought across in previous chapters and discusses the implications regarding the Ramadan effects on the economy. Finally, we points out the limitations of this study as well as the directions for the future study.

2. LITERATURE REVIEW

We could find a number of literatures on the religious influence on and meanings for the social activities. A few studies suggest that cultural dimensions are very dynamic in society, but religious tenets usually form a stable and static pillar in society (Fam, Waller, and Erdogan, 2004). Further, the influence of religious beliefs on individual and social behavior is well documented (Zainul, Osman, and Mazlan, 2004; Fam, Waller, and Erdogan, 2004; Saeed, Ahmed, and Mukhtar, 2001; Mitchell and Al-Mossawi, 1999; McDaniel and Burnett, 1990; LaBarbera, 1987; Luqmani, Yavas, and Quraeshi, 1987; Uppal, 1986).

Although there is a limited literature on the effects of Ramadan on economic variables, literature reveals some studies that investigate the effects of various religious beliefs such as, Ramadan, Christianity and Judaism on, in particular, consumption habits. Consumption of religious products may also be affected by cultural consumption (Odabasi and Argan, 2009; Park and Baker, 2007). Also, Ramadan, as the holiest month of the year, influences society and factors associated with food consumption (Park, 2005; Zinbarg, 2005; Toda and Morimoto, 2004; Kadri *et al.*, 2000; Keng *et al.*, 2000;

Ahmed, 1999).³⁾ Several studies that investigated the effects of Ramadan on food consumption (e.g., Abu-Taleb, 2003; Kadri *et al.*, 2000) indicate a significant increase; however, there are a number of studies (Karaagaoglu and Yucecan, 2000; Roky *et al.*, 2004) that report a decrease in food consumption during the Ramadan period.

Despite the fast, however, grocery sales go up during the month because of the iftar feasts. Similarly, electricity consumption is reported to rise as a result of an increase in late-night socio religious activities and shopping (Seyyed, Abraham, and Al-Hajji, 2005). The increased religious devotion during Ramadan has reinforced the potential for higher profit obtained from the sale of these Ramadan related goods (Ahmed, 1999). Even, people have taken this month to be a month of shopping. Some brands spend as much as half their advertising budget in this month alone (Fattah, 2005). In recent years, performance of Ramadan rituals began to take place more in the public space and in a visibly consumption-oriented manner. Indeed, Ramadan has begun to look like other Western originated holiday rituals, such as Christmas and New Year's season (Sandikci and Omeraki, 2007). The patterns of family expenditure and consumption during Ramadan compared with other months, determines the impact of family socio-economic characteristics on patterns of family budgeting and food expenditure in Egypt (Abu-Taleb, 2003).

Also, production activities in general tend to slow down with reduced working hours in virtually all sectors. For financial sector, we would expect that as much of the time during the month of Ramadan is devoted to socio-religious activities, one would expect a slow-down of financial market activities. For Saudi Arabia, it is found that the number of transactions declines during the Ramadan period and is observed that the decline in volatility with this decreased market activity (Seyyed, Abraham, and Al-Hajji, 2005).

³⁾ In Ramadan *iftar* invitations in personal and in organizational levels continue in a ritualistic manner. This effect inevitably results in more consumption during this month. For example, *pide* (a special bread) and *gullac* (a special dessert related to Ramadan) are consumed not only by fasting consumers, but also by non-fasting individuals as well.

The purpose of the study is to investigate the underlying aspects of Ramadan effects on the macroeconomy, in the overall dimensions including consumption, production, and finance. As a whole, the review of the existing literature on the aspects of Ramadan reveals that there is limited research on the subject that we are interested in, except the food consumption during Ramadan. In this sense, this study, based on the implementation, review of the literature, and discussions, develops the model for empirical investigation to examine the effects of Ramadan on macroeconomic variables more thoroughly. To overcome the limit of the previous literatures we widened our boundary utilizing the GARCH model to estimate the volatility of the variables and extended the data set including production, consumption, and price level for real sector; stock price, broad money (M2), exchange rate level for financial sector; export, import and balance of trade for external sector. It is discussed in more detail below.

3. MODEL AND DATA

First of all, we model the volatility of economic variables as one of the indicators of the effect of Ramadan on the economy.⁴⁾ Based on the assumption that the bigger the effect of Ramadan on the economy, the larger the volatility of economic variables, we examine the volatilities of the economic variables to measure the fluctuation of each variable around Ramadan. The contraction and expansion of the economic variables — it would be reflected on the volatility of the variable — around Ramadan would be bigger because people are believed to rebalance their economic behavior after Ramadan.

To model the volatility of economic variables we utilize the volatility by the conditional volatility models of Engle (1982) and Bollerslev (1986).

⁴⁾ This paper only deals with the issue of volatility of economic variables because the raw data in level are not provided, instead only growth rates or the rate of changes of the variables are provided. Thus, the discussion in this paper is limited to the volatility of changes in the economic variables.

These models employ the volatility clustering, which helps to determine the magnitude but not the sign of the shocks (large (small) percentage changes are followed by large (small) percentage changes). In fact, we could find that in many studies, high frequency financial and economic data present excess kurtosis as compared to the normal distribution and these properties of data are successfully captured by Autoregressive Conditional Heteroskedasticity (ARCH) and ARCH-type specifications since they incorporate the changing volatility in the system (Noh and Kane, 1994; Gouriéroux, 1997; Salman and Salih, 1999). ARCH is first explained by Engel (1982) as the specification capturing the time variation in the data. Bollerslev (1986) develops a more parsimonious representation of the ARCH model which we call the Generalized ARCH (GARCH) specification. In this representation the basic mean and variance equations are written as:

$$\Delta y_t = \omega_t + \sqrt{\sigma_t^2} v_t, \quad (1)$$

$$\sigma_t^2 = \alpha_0 + \alpha(L)\varepsilon_t^2 + \phi(L)\sigma_t^2, \quad (2)$$

where, L is the lag operator and $\alpha(L)$ and $\phi(L)$ are the lag polynomials with orders p and q , respectively; if $1 - \phi(L)$ and $1 - \alpha(L)$ have roots which lie outside the unit circle, an ARCH representation can be written. $\alpha_0 \geq 0$, $\alpha_i \geq 0$, and $\phi_j \geq 0$, $i = 1, \dots, T$ are sufficient conditions to ensure positive variances; similarly, $\sum(\alpha_i + \phi_j) \leq 1$ is necessary to ensure stationarity in the system. Also, the identification of the lag-length in the system can be determined by using the Likelihood-ratio (LR) test, Akaike's information criterion (AIC), and Schwarz's information criterion (SIC) as well as by taking into account the tests for autocorrelation with Ljung-Box Q -statistics and Engle's ARCH-LM test in the data.

The standardized residuals that are represented as $z_t = \hat{\varepsilon}_t / \hat{\sigma}_t$ have mean zero and variance one, and are used in the diagnostics of the identification process. Then, we estimate the conditional standard deviation of each variable using the GARCH process and use it as the volatility of each

economic variable. Therefore if we add Ramadan Dummy variable in the variance equation (2) with the volatility obtained from the previous process, we could estimate the Ramadan effects on the volatility of economic variables.

Regarding the issue of regression with generated regressors Pagan (1984) shows that the parameters of the 2nd stage regression would be inconsistent if the current volatility values are used as regressors because of the measurement error. In the study, instead of using the current volatility values he suggests that consistent estimators are available by applying instrumental variables with the volatility values of the previous term.⁵⁾ Thus, based on the study we use one lagged volatility values as regressors at the 2nd stage estimations to address the measurement error issue.

In this sense, Engle (1982) proposed the Autoregressive Conditional Heteroskedastic (ARCH) model that allows the forecast variance of return to vary systematically over time. The model assumes that the conditional variance, h_t , depends on the lagged squared residuals of returns. The basic ARCH model for returns allows the data to determine the best weights to use in forecasting the changing conditional variance. Bollerslev (1986) extended the ARCH specification by making the conditional variance h_t a function of lagged values of h_t in addition to the lagged values of squared residuals. This

⁵⁾ In the study, the regression equation to represent the structure of modelling variances follows as:

$$y_t = x_t\gamma + \sigma_t^2\delta + e_t. \quad (3)$$

Because observations on σ_t^2 are not available, σ_t^2 is replaced by φ_t^2 , and γ and δ are estimated by regressing y_t against x_t and φ_t^2 . Then, the equation (3) can be re-written as:

$$y_t = x_t\gamma + \varphi_t^2 + (\sigma_t^2 - \varphi_t^2)\delta + e_t. \quad (4)$$

However, due to the measurement error due to the correlation between φ_t^2 and $(\sigma_t^2 - \varphi_t^2)\delta$, the estimator δ is not consistent anymore. The study proposes φ_{t-1}^2 an instrument variable instead of using φ_t^2 to get consistent estimator δ because the correlation between φ_{t-1}^2 and $(\sigma_t^2 - \varphi_t^2)\delta$ is zero. See Pagan (1984), pp. 235-236 for more discussion.

form of the model is known as generalized ARCH (GARCH), which has been extensively used to model financial time series and has proven to be very successful in predicting conditional variances. The most common formulation of GARCH asserts that the best predictor of the variance in the next period is a weighted average of the long-run average variance, the variance predicted for this period and the most recent squared residuals capturing any new information, with declining weights assigned to past squared residuals.

Therefore, basically the effect of Ramadan on the volatility of the economic variables could be examined using the following GARCH specification. The following equation (5) is mean equation which is used to estimate the mean of the economic variables. Further, the time-varying volatility is modeled as a GARCH (p, q) process to estimate the parameters of the variance equation (6). In the equation (6), we add Ramadan Dummy, $D_{RAMADAN}$, and perform the structural break test to examine the existence of the Ramadan effect on the volatility of economic variables.⁶⁾

$$Y_t = \mu_0 + \sum_{i=1}^k \phi_i Y_{t-i} + u_t, \quad u_t = \sqrt{h_t} \varepsilon_t, \quad (5)$$

$$h_t = \nu_0 + \beta D_{RAMADAN} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}, \quad (6)$$

where $D_{RAMADAN} = 1$ for 2 or 3 months are the previous and next month of Ramadan including the month of Ramadan, and 0 for the other months.⁷⁾ ε_t denotes error term at time t . The orders of p and q in conditional variance are a linear function of past squared error and lagged variance. Equations (5)

⁶⁾ Actually, as a pre-study we added the Ramadan Dummy in the mean equation (5) as well, to examine the effect of Ramadan on the mean of economic variables. However, the coefficients are not statistically significant in all cases meaning that in terms of mean, Ramadan effects on the economic variables are minimal or negligible. Therefore, we do not report the estimation results of mean equation adding the mean equation.

⁷⁾ See table A1 in appendix 1 for the Dummy value for Ramadan.

and (6) are estimated jointly using the Full Information Maximum Likelihood procedure to determine the effect of Ramadan on mean of economic variable and its volatility. Here, ν_0 , γ_i , δ_j , each is a non-negative parameter to be estimated, while $p \geq 0$ and $q \geq 0$ define the order of the process and β in the equation captures the Ramadan effect on the volatility. The non-negativity of the estimated parameters is required to obtain positive conditional variances. In addition, the restriction $\gamma_i + \delta_j < 1$ must be satisfied to ensure that the conditional variance is non-explosive and stationary. If the summation equals 1 or is near unity ($\gamma_i + \delta_j = 1$) then the shocks to the current volatility are permanent (i.e., the volatility variable is non-stationary) and the time series exhibit presence of strong persistence. However, if the summation is less than unity, shocks to volatility are temporary and the volatility variable is stationary.

Furthermore, we examine the Christmas effect of the economic variables to compare the Ramadan. The method is similar with the case of Ramadan. With Ramadan Dummy, $D_{RAMADAN}$, the time-varying volatility including Christmas Dummy, $D_{CHRISTMAS}$, is modeled as a GARCH (p, q) process to estimate the parameters of the variance equation (7).

$$h_t = \nu_0 + \alpha_i D_{RAMADAN} + \beta_i D_{CHRISTMAS} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}. \quad (7)$$

Finally, for the analysis, we divide the economic variables into three categories — real, financial, and external sectors. For the variables of real sector we select the industrial manufacturing production growth rate for production, retail sales growth rate for consumption, and headline inflation rate for the price level. Next, for the variables of financial sector we select the composite stock price index for overall stock market, the financial stock price index for financial institutes, and broad money ($M2$) growth rate for money market. Finally, for the variables of external sector we select merchandise export growth rate for export, merchandise import growth rate for import, and foreign exchange rate index for foreign exchange

Table 1 Description of the Data Set

Sector	Variables	Proxy Variables	Abbreviation	Definition, Unit	Time Series (monthly)		Data Source
					Indonesia	Malaysia	
Real Sector	<i>Production</i>	Industrial/ Manufacturing Production Growth Rate	<i>PR</i>	y-o-y, %	1994.3-2013.9	2001.3-2013.8	Asia Regional Integration Center
	<i>Consumption</i>	Retail Sales Growth Rate	<i>RS</i>	y-o-y, %	2002.12-2013.10	-	"
	<i>Price Level</i>	Headline Inflation Rate	<i>INF</i>	y-o-y, %	1991.3-2013.10	1991.2-2013.9	"
Financial Sector	<i>Stock Price Overall</i>	Composite Stock Price Index	<i>CSTOCK</i>	change in monthly average, January 2007=100	1991.4-2013.11	1990.5-2013.12	"
	<i>Stock Price of Financial Institutions</i>	Financial Stock Price Index	<i>FSTOCK</i>	change in monthly average, January 2007=100	1991.4-2013.11	1990.5-2013.12	"
	<i>M2</i>	Growth of Broad Money	<i>M2</i>	y-o-y, %	2005.7-2013.11	2005.7-2013.11	"
External Sector	<i>Export</i>	Merchandise Export Growth Rate	<i>EXP</i>	3-month moving average, y-o-y, %	1991.5-2013.9	1991.5-2013.9	"
	<i>Import</i>	Merchandise Import Growth Rate	<i>IMP</i>	3-month moving average, y-o-y, %	1991.5-2013.9	1991.5-2013.9	"
	<i>Exchange Rate</i>	Exchange Rate Index	<i>EX</i>	monthly average, January 2006 = 100, \$/local currency	1998.7-2013.10	1998.7-2013.10	"

market.⁸⁾ Table 1 presents data description in detail and table A3 and table A4 show the time series graphically.⁹⁾

4. EMPIRICAL RESULTS

Table 2-table 6 reports the estimation results of the GARCH model for the volatility of economic variables. We are interested in the value and the significance level of α and β in equation (6) and (7), which represents the coefficient of dummy variables, $D_{RAMADAN}$ and $D_{CHRISTMAS}$ of the three economic sectors respectively. In detail, table 2 reports the value and the significance level of β in equation (6) for the Ramadan dummy variable of both Indonesia and Malaysia.¹⁰⁾ For the real sector of economy, all the three dummy variable coefficients are positive and statistically significant for Indonesia. On the other hand, one dummy variable coefficient — inflation rate — is positive and statistically significant for Malaysia. This result may imply that for Indonesia, volatilities of real sector economic variables increase much more around Ramadan than other ordinary season. For Malaysia, the result is somewhat ambiguous and the coefficient of inflation rate dummy, 0.082, is much smaller than that of Indonesia. Therefore, we could say that the influence of Ramadan on the real sector of the economy is obvious, at least, for Indonesia but not for Malaysia.

⁸⁾ Overall, the statistics of the variables show negatively skewed and leptokurtic behaviors, which are the signs of heavy-tailed distributions. It is also obvious that the variables are not normally distributed since the Jarque-Bera normality is rejected at the 1 percent significance level. The correlogram Q -statistics for testing autocorrelation present higher autocorrelation for the 36 whole lags. Also, there is evidence for autocorrelation in the squared series since the Q -statistics reject the null hypothesis of no autocorrelation at the 1 percent significance level as well. These diagnostic test results imply the GARCH specification would be more appropriate to construct the volatility measure. We do not report the various diagnostic test results in the paper.

⁹⁾ All data set except composite stock price index and financial stock price index are stationary at level. Thus, for both stock price indexes, we use the 1st differenced data (monthly change) set to make the time stationary. We do not report the stationarity test (ADF test) results in the paper.

¹⁰⁾ See table A2-tableA13 in appendix 2 for the estimation and statistical results for mean and volatility equation in detail.

Table 2 Summary of Ramadan Effect on the Economic Variables

Variance Equation		$h_t = v_0 + \beta D_{RAMAMDAN} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$			
		Indonesia		Malaysia	
		$D_{RAMAMDAN}$		$D_{RAMAMDAN}$	
Sector	Variables	Value of β	Significance Level	Value of β	Significance Level
Real Sector	<i>PR</i>	23.312	***	0.202	-
	<i>RS</i>	32.588	***	-	-
	<i>INF</i>	1.300	***	0.082	***
Financial Sector	<i>CSTOCK</i>	29.313	***	-0.009	-
	<i>FSTOCK</i>	57.291	***	-1.249	-
	<i>M2</i>	0.980	***	0.104	-
External Sector	<i>EXP</i>	2.746	*	6.544	***
	<i>IMP</i>	4.356	*	2.539	*
	<i>EX</i>	-0.214	-	0.161	***

Notes: Significance levels are 10% *, 5% **, and 1% ***. - is not statistically significant.

Also, the results show that for the financial sector, all three dummy variable coefficients are positive and statistically significant for Indonesia, whereas none of the dummy coefficients is statistically significant for Malaysia. This result may also imply that, for Indonesia, the volatilities of economic variables in financial sector increase much more around Ramadan than ordinary season. However, for Malaysia, it seems that Ramadan does not have any significant effect on the financial sector.

For external sector two dummy variable coefficients among three — export growth rate and import growth rate — are positive and statistically significant for Indonesia. Also, all three dummy variable coefficients are positive and statistically significant for Malaysia. This result may imply that volatilities of economic variables for external sector, for both countries, increase much more around Ramadan than ordinary season. Summing up the discussion above, we can say that, at least for Indonesia, the results may support our hypothesis that there would be a greater volatility of economic

variables around Ramadan in all economic sectors. It also implies that for Indonesia, people have an obvious tendency or willingness to rebalance and compensate for the shrinking and discouragement of the economic activities owing to the religious belief, whereas it is not clear for Malaysia except financial market.

Furthermore, we examine whether the impact of Ramadan on the economic variables get strengthened or reinforced with the passage of time. We could assume that if Ramadan gets more influential on the volatility of economic variables it may indicate that the religious faith and/or activities of people get strengthened as well. Here, we divide the periods into two, 1990-2000 and 2001-2013 and estimate the volatility of two periods for Indonesia and Malaysia. We splits the sample around 2000 because it is believed that overall the Islamization policy driven by the governments of two countries were more accelerated and strengthened in 2000s. Table 3-table 4 present the estimation results.¹¹⁾

Although we could not achieve the full set of results for 9 economic variables owing to the lack of data in 1990s, we could see that overall the magnitude of volatility of economic variables got larger for the period 2001-2013 compared with that of the period 1990-2000, especially for Malaysia. For Indonesia, the two coefficients — inflation rate and composite stock price index — got larger in 2001-2013 compared with 1990-2000. On the other hand, for Malaysia the four coefficients — inflation rate, composite stock price index, broad money growth rate, and import growth rate — got larger in 2001-2013 compared with 1990-2000.

Thus, we may say that Ramadan effects on the economic variables have been reinforced in terms of economic volatility as time goes on and it is more obvious for Malaysia. It would be due to the Islamization policy supported by governments which may induce, in terms of economic activities, the people to decide and behave in a more Islamic way, especially for Malay people.

¹¹⁾ We do not report the estimation and statistical results for mean and volatility equation in detail in the paper for simplicity.

Table 3 Summary of Ramadan effect on the Economic Variables for Two Periods (Indonesia)

Variance Equation		$h_t = v_0 + \beta D_{RAMAMDAN} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$			
		1990-2000		2001-2013	
		$D_{RAMAMDAN}$		$D_{RAMAMDAN}$	
Sector	Variables	Value of β	Significance Level	Value of β	Significance Level
Real Sector	<i>PR</i>	38.946	*	18.793	***
	<i>RS</i>	-	-	N/A	-
	<i>INF</i>	0.548	-	3.091	***
Financial Sector	<i>CSTOCK</i>	-1.318	**	24.886	***
	<i>FSTOCK</i>	-	-	N/A	-
	<i>M2</i>	-	-	N/A	-
External Sector	<i>EXP</i>	0.383	-	-1.230	-
	<i>IMP</i>	6.840	-	-12.568	-
	<i>EX</i>	-36.920	-	-0.109	-

Notes: Significance levels are 10% *, 5% **, and 1% ***. - is not statistically significant.

Table 4 Summary of Ramadan Effect on the Economic Variables for Two periods (Malaysia)

Variance Equation		$h_t = v_0 + \beta D_{RAMAMDAN} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$			
		1990-2000		2001-2013	
		$D_{RAMAMDAN}$		$D_{RAMAMDAN}$	
Sector	Variables	Value of β	Significance Level	Value of β	Significance Level
Real Sector	<i>PR</i>	-	-	N/A	-
	<i>RS</i>	-	-	N/A	-
	<i>INF</i>	-0.006	-	0.092	***
Financial Sector	<i>CSTOCK</i>	-6.839	**	3.609	*
	<i>FSTOCK</i>	-	-	N/A	-
	<i>M2</i>	0.524	-	1.247	**
External Sector	<i>EXP</i>	9.521	**	4.023	**
	<i>IMP</i>	0.486	-	2.570	*
	<i>EX</i>	-	-	N/A	-

Notes: Significance levels are 10% *, 5% **, and 1% ***. - is not statistically significant.

Next, we add the Christmas dummy in the variance equation (7) to see there are any significant volatility difference between Ramadan and Christmas.¹²⁾ Table 5 and table 6 report the value of α and β for the Ramadan and Christmas dummy variable of Indonesia and Malaysia, respectively. First, from table 5, we notice that for Indonesia, there is significant difference between the effect of Ramadan and Christmas on the economic variables. In other words, as we saw above, the volatilities of economic variables get larger around Ramadan as well. On the contrary for Christmas, the volatilities of economic variables do not seem to have any significant change around Christmas season.

In the case of Ramadan dummy, all three coefficients for real sector economic variables are positive and statistically significant for Indonesia, whereas none of the dummy coefficients is statistically significant for Christmas season. This result may imply that volatilities of real sector economic variables of Indonesia increase much more around Ramadan than ordinary season, but it is not the case for Christmas. For financial sector all three dummy variable coefficients are positive and statistically significant for Ramadan. On the other hand, only one dummy variable coefficient — for broad money growth rate — is statistically significant for Christmas but the value is negative, meaning the volatilities even go down around Christmas. This result may imply that volatility of financial sector economic variables of increase around Ramadan but no change or even opposite for Christmas. Finally, for external sector one dummy variable coefficient — for import growth rate — is positive and statistically significant for Ramadan. On the other hand, only one coefficient of exchange rate index is statistically significant for Christmas but the value is negative, meaning the volatilities go down around Christmas. This result, even though not much clear as real and financial sector, may imply that volatilities of external sector economic variables increase around Ramadan but no change or even opposite for Christmas. Therefore, for Indonesia, we can say that the results may support

¹²⁾ In this case, we estimate the volatility for 2004-2013, because the Christmas season are overlapped with Ramadan for 1996-2003. See the table A1 of appendix 1.

Table 5 Summary of Ramadan and Christmas Effect on the Economic Variables (Indonesia, 2004-2013)

Variance Equation		$h_t = v_0 + \alpha D_{RAMAMDAN} + \beta D_{CHRISTMAS} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$					
		$D_{RAMAMDAN}$			$D_{CHRISTMAS}$		
Sector	Variables	Value of β	Significance Level	Value of β	Significance Level		
Real Sector	<i>PR</i>	8.635	***	-0.044	-		
	<i>RS</i>	82.610	***	6.245	-		
	<i>INF</i>	3.977	***	0.010	-		
Financial Sector	<i>CSTOCK</i>	62.527	***	-8.896	-		
	<i>FSTOCK</i>	30.770	*	2.547	-		
	<i>M2</i>	1.825	***	-2.323	***		
External Sector	<i>EXP</i>	-0.818	-	15.510	-		
	<i>IMP</i>	21.608	*	49.312	-		
	<i>EX</i>	0.654	-	-1.216	***		

Note: Significance levels are 10% *, 5% **, and 1% ***.

Table 6 Summary of Ramadan and Christmas Effect on the Economic Variables (Malaysia, 2004-2013)

Variance Equation		$h_t = v_0 + \alpha D_{RAMAMDAN} + \beta D_{CHRISTMAS} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$					
		$D_{RAMAMDAN}$			$D_{CHRISTMAS}$		
Sector	Variables	Value of β	Significance Level	Value of β	Significance Level		
Real Sector	<i>PR</i>	2.448	-	10.663	***		
	<i>RS</i>	-	-	-	-		
	<i>INF</i>	-0.321	***	-0.051	***		
Financial Sector	<i>CSTOCK</i>	-0.623	-	-1.982	-		
	<i>FSTOCK</i>	1.656	-	-11.546	***		
	<i>M2</i>	1.055	-	-0.469	-		
External Sector	<i>EXP</i>	6.233	***	2.548	-		
	<i>IMP</i>	4.739	***	9.695	**		
	<i>EX</i>	1.742	-	-0.590	-		

Note: Significance levels are 10% *, 5% **, and 1% ***.

our hypothesis that there would be a greater volatility of economic variables around Ramadan but not the case for Christmas. This implies that people of Indonesia have asymmetric tendency for two main religious rituals, Ramadan and Christmas regarding on the economic decision and behaviors.

Also, from table 6, for Malaysia, the effect of Ramadan and Christmas on the economic variables are not clear as the case of Indonesia above. Even, for financial sector, the volatilities of economic variables do not seem to have any significant change both around Ramadan and Christmas. In detail, the case of Ramadan dummy, only one coefficient for real sector economic variables — inflation rate — is negative and statistically significant. In the case of Christmas dummy the coefficient of production growth rate is only positive and statistically significant, and the coefficient of inflation rate is negative and statistically significant. For financial sector none of the dummy coefficients except the financial stock market index for Christmas are statistically significant both for Ramadan and Christmas. For external sector two dummy coefficients — export growth rate and import growth rate — are positive and statistically significant for Ramadan. On the other hand, the coefficient of import growth rate is positive and statistically significant for Christmas. Summing up, we got mixed results in the case of Malaysia.

We may propose two considerable reasons for that. First, for Malaysia even though the Islamization could be faster than Indonesia, the size or the portion of Islam population and Islam economy is small than that of Indonesia. Malay people who are Muslim compose around 60% of the population of Malaysia, whereas for Indonesia the ratio of Muslim is over 90%. Second, for Malaysia, the Ramadan factor might be internalized in terms of the economic behavior, which would result in the evenly time distribution of Ramadan effects on the economic variables. In that case for Malaysia, Ramadan may not be the major factor that affects the volatility of economic variables.

5. CONCLUSION

The existence of a certain degree of correlation between religion and economy has been widely studied and generally accepted. However, there are few quantitative analyses on the subject. Therefore, it is worthwhile to discuss and study on the probability of the impact of religion on the economy in terms of quantitative way. We starts the study from the basic question how we can measure the effect of religion on the economy in quantitative format. To answer the question this paper examined the impact of Ramadan, which is one of the most popular and typical religious ceremony of Islam, on the macroeconomic variables, including real, financial and external sectors. We investigated the cases for Indonesia and Malaysia of Southeast Asia because Islamic factors, such as Islamization policy supported by the government, have been spreading quickly and widely among the people. Also, we utilize the GARCH model to estimate the volatility of the economic variables.

From the analysis, we found that there are significant changes or differences in the movement of the economic variables, overall, around (before and after) Ramadan, especially for Indonesia. The result would support our hypothesis that the religion may affect the economic decision-making or behavior of people who have Islamic faith. In other words, the volatility of economic variables could get larger because people tend and want to rebalance or compensate for the economic contraction during Ramadan period. The economic contraction during Ramadan could bring people into more excessive economic activities after Ramadan. This contraction and excess around Ramadan would be one of the main reasons for the increase in the volatility of economic variables. In addition, we got some evidences that, especially for Malaysia, the impact of Ramadan on the economic variables get strengthened with the passage of time. It may due to the government's policy and support for Islamic faith and/or activities.

On the other hand, we add Christmas dummy to examine the difference in the effect of Ramadan and Christmas for both countries. We got interesting

results which implies that the volatility of external sector economic variables increases around Ramadan period but no change or even opposite for Christmas. In brief, for Indonesia, people may have an asymmetric tendency for two main religious rituals, Ramadan and Christmas in terms of economic decisions and behaviors. However, the empirical results show some mixed or ambiguous results in the case of Malaysia. For Malaysia, it seems that the effects of Ramadan and Christmas on the economic variables are not clear as Indonesia. Even, for financial sector, the volatility of economic variables does not seem to have any significant change both around Ramadan and Christmas. Therefore, at least, we may not say that the volatility of economic variables show significant differences compared with the case of Indonesia.

Summing up the discussion above, we got some evidences that a religious ritual activity — here Ramadan — could impose significant impacts on the economic decisions and behaviors of people which bring in much bigger fluctuation of economic variables around Ramadan. Thus, we can say that religion could have crucial influence on the economy at least for Indonesia over last two decades in terms of quantitative way. Also, for Malaysia the Islamization policy seems to have been more influential on the economic variables in 2000-2013 compared with 1990s.

We acknowledge that the paper did not consider other factors that might have impacts on the economic variables or might bring a structural change in the economy like 1998 Asian financial crisis and 2009 global financial crisis for the estimation. The next interesting area that should be investigated is the cases for different Muslim countries. Different countries may have different cultural and economic background and implications regarding Ramadan. Therefore, a different aspect of Ramadan, in terms of economy, can provide interesting results and new insights into economic decision making procedures and practices during Ramadan, which should be studied in future research. Also, we can suggest that a future study would compare different samples of Muslim countries with special cultural habits on this issue.

APPENDIX 1

Table A1 Time Table of Ramadan (1990-2013)

Year	Ramadan Period	Overlapping with Christmas and New Year Holidays	Months for $D_{RAMADAN} = 1$
1990	3.28-4.27	N	March, April, May
1991	3.17-4.16	N	March, April, May
1992	3.5-4.4	N	Feb, March, April
1993	2.23-3.25	N	February, March, April
1994	2.12-3.14	N	January, February, March
1995	2.1-3.3	N	January, February, March
1996	1.22-2.21	Y	January, February, March
1997	1.10-2.9	Y	December 1996, January, February
1998	12.20-1.19	Y	December, January, February
1999	12.9-1.7	Y	November 1998, December, January
2000	11.28-12.28	Y	November, December, January
2001	11.17-12.17	Y	November, December, January
2002	11.6-12.4	Y	October, November, December
2003	10.26-11.24	Y	October, November, December
2004	10.15-11.13	N	October, November
2005	10.4-11.2	N	September, October, November
2006	9.24-10.22	N	September, October, November
2007	9.13-10.12	N	August, September, October
2008	9.1-9.30	N	August, September, October
2009	8.22-9.19	N	August, September, October
2010	8.11-9.9	N	July, August, September
2011	8.1-8.29	N	July, August, September
2012	7.20-8.18	N	July, August, September
2013	7.9-8.7	N	June, July, August

Note: Months for $D_{CHRISTMAS} = 1$ are December and January of next year for the whole time set.

APPENDIX 2 Estimation Results of GARCH Model

Table A2 Results of the GARCH Process of Ramadan Effect on Real Sector Variables (Indonesia)

Real Sector	<i>Production</i>	<i>Consumption</i>	<i>Inflation</i>
Variables	<i>Industrial/ Manufacturing Production Growth Rate</i>	<i>Retail Sales Growth Rate</i>	<i>Headline Inflation Rate</i>
Abbreviation	$PR_{Indonesia}$	$RS_{Indonesia}$	$INF_{Indonesia}$
Mean Equation (Y represents each variable)	$Y_t = \mu_0 + \sum_{i=1}^k \phi_i Y_{t-i} + u_t, u_t = \sqrt{h_t} \varepsilon_t$		
C	0.493 ⁺ (0.308)	3.021 ^{***} (0.613)	0.581 ^{***} (0.082)
$L(1)$	0.540 ^{***} (0.308)	0.741 ^{***} (0.054)	1.483 ^{***} (0.068)
$L(2)$	0.341 ^{***} (0.069)	-	-0.557 ^{***} (0.064)
Variance Equation	$h_t = v_0 + \beta_1 D_{RAMADAN} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$		
C	2.116 [*] (1.116)	31.891 ^{***} (5.068)	0.069 ^{***} (0.025)
γ	0.416 ^{***} (0.076)	0.432 ^{***} (0.122)	0.381 ^{***} (0.067)
δ	0.370 ^{***} (0.070)	-0.090 [*] (0.049)	0.471 ^{***} (0.034)
$D_{RAMADAN}$	23.312 ^{***} (4.641)	32.588 ^{***} (16.466)	1.300 ^{***} (0.085)
$\gamma + \delta$	0.786	0.342	0.852
AIC	6.055	7.010	3.126
SIC	6.158	7.142	3.219
$D-W$	2.508	2.367	1.452
$Adj. R^2$	0.481	0.475	0.979
<i>Time Series</i>	1994.3-2013.9	2002.12-2013.10	1991.3-2013.10
Obs.	235	131	272

Notes: Significance levels are 15% ⁺, 10% ^{*}, 5% ^{**}, and 1% ^{***}. ε_t and h_t denote error terms and conditional standard deviation at time t , respectively. AIC is for Akaike Information criterion; SIC is for Schwarz Information Criterion; and D-W is for Durbin-Watson statistic.

Table A3 Results of the GARCH Process of Ramadan Effect on Financial Sector Variables (Indonesia)

Financial Sector	<i>Stock Price Overall</i>	<i>Stock Price of Financial Institutions</i>	<i>M2</i>
Variables	<i>Composite Stock Price Index</i>	<i>Financial Stock Price Index</i>	<i>Growth of Broad Money (M2)</i>
Abbreviation	<i>CSTOCK_{Indonesia}</i>	<i>FSTOCK_{Indonesia}</i>	<i>M2_{Indonesia}</i>
Mean Equation (Y represents each variable)	$Y_t = \mu_0 + \sum_{i=1}^k \phi_i Y_{t-i} + u_t, u_t = \sqrt{h_t} \varepsilon_t$		
<i>C</i>	0.541** (0.264)	0.064 (0.359)	3.991*** (1.181)
<i>L(1)</i>	0.366*** (0.041)	0.483*** (0.063)	0.745*** (0.074)
<i>L(2)</i>	-0.098** (0.041)	-	-
Variance Equation	$h_t = v_0 + \beta_1 D_{RAMADAN} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$		
<i>C</i>	25.541*** (3.218)	12.000*** (2.058)	0.519** (0.212)
γ	-	0.819*** (0.221)	0.051 (0.074)
δ	0.470*** (0.108)	-	0.881*** (0.080)
<i>D_{RAMADAN}</i>	29.313*** (4.131)	57.291*** (7.195)	0.980*** (0.345)
$\gamma + \delta$	0.470	0.819	0.932
<i>AIC</i>	5.912	6.681	3.834
<i>SIC</i>	5.991	6.774	3.989
<i>D-W</i>	1.952	2.223	1.947
<i>Adj. R²</i>	0.118	0.008	0.588
<i>Time Series</i>	1991.4-2013.11	2000.3-2013.12	2005.7-2013.11
Obs.	272	166	101

Notes: Significance levels are 15% +, 10% *, 5% **, and 1% ***. ε_t and h_t denote error terms and conditional standard deviation at time t , respectively. AIC is for Akaike Information criterion; SIC is for Schwarz Information Criterion; and D-W is for Durbin-Watson statistic.

Table A4 Results of the GARCH Process of Ramadan Effect on External Sector Variables (Indonesia)

Eternal Sector	<i>Export</i>	<i>Import</i>	<i>Exchange Rate</i>
Variables	<i>Merchandise Export Growth</i>	<i>Merchandise Import Growth</i>	<i>Exchange Rate Index</i>
Abbreviation	$EXP_{Indonesia}$	$IMP_{Indonesia}$	$EX_{Indonesia}$
Mean Equation (Y represents each variable)	$Y_t = \mu_0 + \sum_{i=1}^k \phi_i Y_{t-i} + u_t, u_t = \sqrt{h_t} \varepsilon_t$		
C	0.561** (0.245)	0.481*** (0.370)	10.594*** (2.535)
$L(1)$	1.502*** (0.053)	1.605*** (0.050)	0.897*** (0.025)
$L(2)$	-0.569*** (0.051)	-0.663*** (0.049)	-
Variance Equation	$h_t = v_0 + \beta_t D_{RAMADAN} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$		
C	-0.118 (0.574)	0.423 (0.928)	0.523** (0.231)
γ	0.110** (0.051)	0.103*** (0.041)	0.579*** (0.124)
δ	0.842*** (0.064)	0.835*** (0.053)	0.542*** (0.053)
$D_{RAMADAN}$	2.746* (1.622)	4.356* (2.509)	-0.214 (0.430)
$\gamma + \delta$	0.952	0.938	1.021
AIC	5.545	6.240	5.026
SIC	5.638	6.334	5.130
$D-W$	1.908	2.477	1.330
$Adj. R^2$	0.941	0.955	0.831
<i>Time Series</i>	1991.5-2013.9	1991.5-2013.9	1998.7-2013.10
Obs.	269	269	184

Notes: Significance levels are 15% +, 10% *, 5% **, and 1% ***. ε_t and h_t denote error terms and conditional standard deviation at time t , respectively. AIC is for Akaike Information criterion; SIC is for Schwarz Information Criterion; and D-W is for Durbin-Watson statistic.

Table A5 Results of the GARCH Process of Ramadan Effect on Real Sector Variables (Malaysia)

Real Sector	<i>Production</i>	<i>Consumption</i>	<i>Inflation</i>
Variables	<i>Industrial/ Manufacturing Production Growth Rate</i>	<i>Retail Sales Growth Rate</i>	<i>Headline Inflation Rate</i>
Abbreviation	$PR_{Malaysia}$	$RS_{Malaysia}$	$INF_{Malaysia}$
Mean Equation (Y represents each variable)	$Y_t = \mu_0 + \sum_{i=1}^k \phi_i Y_{t-i} + u_t, \quad u_t = \sqrt{h_t} \varepsilon_t$		
C	0.634* (0.364)	-	0.109** (0.049)
$L(1)$	0.545*** (0.102)	-	0.958*** (0.015)
$L(2)$	0.296*** (0.089)	-	-
Variance Equation	$h_t = v_0 + \beta_1 D_{RAMADAN} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$		
C	8.140 (8.110)	-	0.153*** (0.012)
γ	0.123 (0.113)	-	0.965*** (0.078)
δ	0.249 (0.669)	-	-0.044** (0.019)
$D_{RAMADAN}$	0.202 (2.106)	-	0.082 (0.019)
$\gamma + \delta$	0.372	-	0.921
AIC	5.492	-	1.236
SIC	5.633	-	1.305
$D-W$	2.003	-	1.440
$Adj. R^2$	0.662	-	0.893
<i>Time Series</i>	2001.3-2013.8	-	1991.2-2013.9
Obs.	150	-	272

Notes: Significance levels are 15% +, 10% *, 5% **, and 1% ***. ε_t and h_t denote error terms and conditional standard deviation at time t , respectively. AIC is for Akaike Information criterion; SIC is for Schwarz Information Criterion; and D-W is for Durbin-Watson statistic.

Table A6 Results of the GARCH Process of Ramadan Effect on Financial Sector Variables (Malaysia)

Financial Sector	<i>Stock Price Overall</i>	<i>Stock Price of Financial Institutions</i>	<i>M2</i>
Variables	<i>Composite Stock Price Index</i>	<i>Financial Stock Price Index</i>	<i>Growth of Broad Money (M2)</i>
Abbreviation	$CSTOCK_{Malaysia}$	$FSTOCK_{Malaysia}$	$M2_{Malaysia}$
Mean Equation (Y represents each variable)	$Y_t = \mu_0 + \sum_{i=1}^k \phi_i Y_{t-i} + u_t, \quad u_t = \sqrt{h_t} \varepsilon_t$		
C	0.339* (0.193)	0.296 (0.289)	0.271 (0.174)
L(1)	0.396*** (0.067)	0.372*** (0.078)	0.976*** (0.015)
L(2)	-0.013* (0.072)	-	-
Variance Equation	$h_t = v_0 + \beta_1 D_{RAMADAN} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$		
C	0.559 (0.481)	1.173* (0.697)	0.005 (0.039)
γ	0.182*** (0.052)	0.197*** (0.075)	0.053* (0.029)
δ	0.791*** (0.050)	0.759*** (0.065)	0.929*** (0.037)
$D_{RAMADAN}$	-0.009 (1.033)	-1.249 (1.169)	0.104 (0.162)
$\gamma + \delta$	0.973	0.956	0.982
AIC	5.374	5.503	3.352
SIC	5.464	5.616	3.431
D-W	1.964	2.036	1.876
Adj. R ²	0.139	0.072	0.948
Time Series	1990.5-2013.12	2000.3-2013.12	1991.2-2013.11
Obs.	284	166	101

Notes: Significance levels are 15% +, 10% *, 5% **, and 1% ***. ε_t and h_t denote error terms and conditional standard deviation at time t , respectively. AIC is for Akaike Information criterion; SIC is for Schwarz Information Criterion; and D-W is for Durbin-Watson statistic.

Table A7 Results of the GARCH Process of Ramadan Effect on External Sector Variables (Malaysia)

Eternal Sector	<i>Export</i>	<i>Import</i>	<i>Exchange Rate</i>
Variables	<i>Merchandise Export Growth</i>	<i>Merchandise Import Growth</i>	<i>Exchange Rate Index</i>
Abbreviation	<i>EXP_{Malaysia}</i>	<i>IMP_{Malaysia}</i>	<i>EX_{Malaysia}</i>
Mean Equation (Y represents each variable)	$Y_t = \mu_0 + \sum_{i=1}^k \phi_i Y_{t-i} + u_t, \quad u_t = \sqrt{h_t} \varepsilon_t$		
<i>C</i>	0.178 (0.291)	0.493* (0.275)	1.551 (1.580)
<i>L</i> (1)	0.967*** (0.017)	1.417*** (0.068)	1.300*** (0.977)
<i>L</i> (2)	–	–0.469*** (0.068)	–0.315*** (0.099)
Variance Equation	$h_t = v_0 + \beta_1 D_{RAMADAN} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$		
<i>C</i>	1.267+ (0.808)	2.829** (1.395)	0.005 (0.007)
γ	0.273*** (0.090)	0.282*** (0.101)	–0.035*** (0.003)
δ	0.517*** (0.105)	0.486*** (0.144)	1.029*** (0.014)
<i>D_{RAMADAN}</i>	6.544*** (1.427)	2.539* (1.476)	0.161*** (0.049)
$\gamma + \delta$	0.790	0.768	0.994
<i>AIC</i>	5.387	5.471	3.443
<i>SIC</i>	5.467	5.565	3.619
<i>D-W</i>	1.248	2.361	1.807
<i>Adj. R²</i>	0.917	0.950	0.967
<i>Time Series</i>	1991.4-2013.9	1991.5-2013.9	2005.1-2013.10
Obs.	270	269	184

Notes: Significance levels are 15% +, 10% *, 5% **, and 1% ***. ε_t and h_t denote error terms and conditional standard deviation at time t , respectively. AIC is for Akaike Information criterion; SIC is for Schwarz Information Criterion; and D-W is for Durbin-Watson statistic.

Table A8 Comparison of the GARCH Process of Ramadan and Christmas Effect on Real Sector Variables (Indonesia, 2004-2013)

Real Sector	<i>Production</i>	<i>Consumption</i>	<i>Inflation</i>
Variables	<i>Industrial/ Manufacturing Production Growth Rate</i>	<i>Retail Sales Growth Rate</i>	<i>Headline Inflation Rate</i>
Abbreviation	<i>PR</i> _{Indonesia}	<i>RS</i> _{Indonesia}	<i>INF</i> _{Indonesia}
Mean Equation (<i>Y</i> represents each variable)	$Y_t = \mu_0 + \sum_{i=1}^k \phi_i Y_{t-i} + u_t, u_t = \sqrt{h_t} \varepsilon_t$		
<i>C</i>	0.944** (0.395)	2.059*** (0.595)	0.387** (0.169)
<i>L</i> (1)	0.415*** (0.103)	0.755*** (0.040)	0.954*** (0.021)
<i>L</i> (2)	0.266*** (0.088)	-	-
Variance Equation	$h_t = v_0 + \alpha_1 D_{RAMADAN} + \beta_1 D_{CHRISTMAS} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$		
<i>C</i>	-0.096 (0.735)	2.083 (1.820)	0.268*** (0.073)
γ	0.110* (0.063)	-	0.474*** (0.173)
δ	0.678*** (0.143)	0.609*** (0.082)	-
<i>D</i> _{RAMADAN}	8.635*** (2.511)	82.610*** (22.239)	3.977*** (0.406)
<i>D</i> _{CHRISTMAS}	-0.044 (2.561)	6.245 (17.505)	0.010 (0.113)
$\gamma + \delta$	0.788	0.609	0.474
<i>AIC</i>	5.287	6.815	2.849
<i>SIC</i>	5.478	6.957	2.990
<i>D-W</i>	2.116	2.409	1.591
<i>Adj. R</i> ²	0.313	0.488	0.874
<i>Time Series</i>	2004.3-2013.9	2004.2-2013.10	2004.2-2013.10
Obs.	115	117	117

Notes: Significance levels are 15% +, 10% *, 5% **, and 1% ***. ε_t and h_t denote error terms and conditional standard deviation at time t , respectively. AIC is for Akaike Information criterion; SIC is for Schwarz Information Criterion; and D-W is for Durbin-Watson statistic.

Table A9 Comparison of the GARCH Process of Ramadan and Christmas Effect on Financial Sector Variables (Indonesia, 2004-2013)

Financial Sector	<i>Stock Price Overall</i>	<i>Stock Price of Financial Institutions</i>	<i>M2</i>
Variables	<i>Composite Stock Price Index</i>	<i>Financial Stock Price Index</i>	<i>Growth of Broad Money (M2)</i>
Abbreviation	<i>CSTOCK_{Indonesia}</i>	<i>FSTOCK_{Indonesia}</i>	<i>M2_{Indonesia}</i>
Mean Equation (Y represents each variable)	$Y_t = \mu_0 + \sum_{i=1}^k \varphi_i Y_{t-i} + u_t, \quad u_t = \sqrt{h_t} \varepsilon_t$		
C	1.416*** (0.531)	1.679* (0.907)	4.249*** (1.039)
L(1)	0.280*** (0.023)	0.238*** (0.089)	0.730*** (0.069)
L(2)	-	-	-
Variance Equation	$h_t = v_0 + \alpha_1 D_{RAMADAN} + \beta_1 D_{CHRISTMAS} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$		
C	52.577*** (14.801)	59.715*** (12.074)	5.615*** (1.224)
γ	-	0.061*** (0.004)	-
δ	-0.539** (0.237)	-	-0.579** (0.268)
$D_{RAMADAN}$	62.527*** (15.830)	30.770* (17.244)	1.825*** (0.695)
$D_{CHRISTMAS}$	-8.896 (8.456)	2.547 (18.615)	-2.323*** (0.454)
$\gamma + \delta$	-0.539	0.061	-0.579
AIC	6.622	7.127	3.803
SIC	6.764	7.268	3.959
D-W	1.863	1.875	1.914
Adj. R ²	0.096	0.053	0.588
Time Series	2004.3-2013.11	2004.3-2013.12	2005.7-2013.11
Obs.	117	118	101

Notes: Significance levels are 15% +, 10% *, 5% **, and 1% ***. ε_t and h_t denote error terms and conditional standard deviation at time t , respectively. AIC is for Akaike Information criterion; SIC is for Schwarz Information Criterion; and D-W is for Durbin-Watson statistic.

Table A10 Comparison of the GARCH Process of Ramadan and Christmas Effect on External Sector Variables (Indonesia, 2004-2013)

External Sector	<i>Export</i>	<i>Import</i>	<i>Exchange Rate</i>
Variables	<i>Merchandise Export Growth</i>	<i>Merchandise Import Growth</i>	<i>Exchange Rate Index</i>
Abbreviation	<i>EXP</i> _{Indonesia}	<i>IMP</i> _{Indonesia}	<i>EX</i> _{Indonesia}
Mean Equation (<i>Y</i> represents each variable)	$Y_t = \mu_0 + \sum_{i=1}^k \phi_i Y_{t-i} + u_t, u_t = \sqrt{h_t} \varepsilon_t$		
<i>C</i>	-0.037 (0.648)	0.483 (0.708)	3.305 (2.438)
<i>L</i> (1)	0.920*** (0.027)	0.941*** (0.013)	0.964*** (0.025)
<i>L</i> (2)	-	-	-
Variance Equation	$h_t = v_0 + \alpha_t D_{RAMADAN} + \beta_t D_{CHRISTMAS} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$		
<i>C</i>	9.738*** (3.477)	35.499*** (11.052)	1.066*** (0.370)
γ	0.616** (0.244)	0.580*** (0.209)	0.496*** (0.123)
δ	-	-0.184*** (0.004)	0.372*** (0.105)
<i>D</i> _{RAMADAN}	-0.818 (3.736)	21.608* (11.119)	0.654 (0.649)
<i>D</i> _{CHRISTMAS}	15.510 (15.249)	49.312 (34.505)	-1.216 (0.342)
$\gamma + \delta$	0.616	0.396	0.868
<i>AIC</i>	6.062	6.685	4.159
<i>SIC</i>	6.204	6.851	4.324
<i>D-W</i>	0.650	0.826	1.480
<i>Adj. R</i> ²	0.906	0.912	0.867
<i>Time Series</i>	2004.2-2013.9	2004.2-2013.9	2004.2-2013.10
Obs.	116	116	117

Notes: Significance levels are 15% +, 10% *, 5% **, and 1% ***. ε_t and h_t denote error terms and conditional standard deviation at time t , respectively. AIC is for Akaike Information criterion; SIC is for Schwarz Information Criterion; and D-W is for Durbin-Watson statistic.

Table A11 Comparison of the GARCH Process of Ramadan and Christmas Effect on Real Sector Variables (Malaysia, 2004-2013)

Real Sector	<i>Production</i>	<i>Consumption</i>	<i>Inflation</i>
Variables	<i>Industrial/ Manufacturing Production Growth Rate</i>	<i>Retail Sales Growth Rate</i>	<i>Headline Inflation Rate</i>
Abbreviation	<i>PR_{Malaysia}</i>	<i>RS_{Malaysia}</i>	<i>INF_{Malaysia}</i>
Mean Equation (<i>Y</i> represents each variable)	$Y_t = \mu_0 + \sum_{i=1}^k \phi_i Y_{t-i} + u_t, u_t = \sqrt{h_t} \varepsilon_t$		
<i>C</i>	0.707** (0.359)	-	0.185*** (0.059)
<i>L</i> (1)	0.821*** (0.060)	-	0.916*** (0.022)
<i>L</i> (2)	-	-	-
Variance equation	$h_t = v_0 + \alpha_i D_{RAMADAN} + \beta_i D_{CHRISTMAS} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$		
<i>C</i>	-1.023 (1.932)	-	0.362*** (0.050)
γ	-	-	-
δ	0.820*** (0.151)	-	0.344*** (0.086)
<i>D_{RAMADAN}</i>	2.448 (1.944)	-	-0.321 (0.046)
<i>D_{CHRISTMAS}</i>	10.663 (3.811)	-	-0.051 (0.003)
$\gamma + \delta$	0.820	-	0.344
<i>AIC</i>	5.343	-	1.685
<i>SIC</i>	5.486	-	1.827
<i>D-W</i>	2.443	-	1.146
<i>Adj. R²</i>	0.640	-	0.860
<i>Time Series</i>	2004.2-2013.8	-	2004.2-2013.9
Obs.	115	-	116

Notes: Significance levels are 15% +, 10% *, 5% **, and 1% ***. ε_t and h_t denote error terms and conditional standard deviation at time t , respectively. AIC is for Akaike Information criterion; SIC is for Schwarz Information Criterion; and D-W is for Durbin-Watson statistic.

Table A12 Comparison of the GARCH Process of Ramadan and Christmas Effect on Financial Sector Variables (Malaysia, 2004-2013)

Financial Sector	<i>Stock Price Overall</i>	<i>Stock Price of Financial Institutions</i>	<i>M2</i>
Variables	<i>Composite Stock Price Index</i>	<i>Financial Stock Price Index</i>	<i>Growth of Broad Money (M2)</i>
Abbreviation	<i>CSTOCK_{Malaysia}</i>	<i>FSTOCK_{Malaysia}</i>	<i>M2_{Malaysia}</i>
Mean Equation (Y represents each variable)	$Y_t = \mu_0 + \sum_{i=1}^k \phi_i Y_{t-i} + u_t, u_t = \sqrt{h_t} \varepsilon_t$		
C	0.460 (0.341)	0.581*** (0.205)	0.682+ (0.432)
L(1)	0.301*** (0.095)	0.400*** (0.043)	0.962*** (0.024)
L(2)	-	-	-
Variance Equation	$h_t = v_0 + \alpha_1 D_{RAMADAN} + \beta_1 D_{CHRISTMAS} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$		
C	1.595 (1.276)	23.903*** (3.687)	1.850 (1.363)
γ	0.165* (0.098)	-	0.173 (0.139)
δ	0.767*** (0.100)	0.634*** (0.098)	0.046 (0.508)
$D_{RAMADAN}$	-0.623 (1.726)	1.656 (1.478)	1.055 (0.860)
$D_{CHRISTMAS}$	-1.982 (1.687)	-11.546*** (2.885)	-0.469 (0.748)
$\gamma + \delta$	0.932	0.634	0.219
AIC	5.335	5.512	3.878
SIC	5.499	5.676	4.043
D-W	2.064	2.208	1.772
Adj. R ²	0.006	0.047	0.942
Time Series	2004.3-2013.12	2004.3-2013.12	2004.2-2013.11
Obs.	118	118	118

Notes: Significance levels are 15% +, 10% *, 5% **, and 1% ***. ε_t and h_t denote error terms and conditional standard deviation at time t , respectively. AIC is for Akaike Information criterion; SIC is for Schwarz Information Criterion; and D-W is for Durbin-Watson statistic.

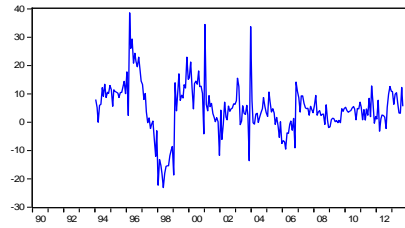
Table A13 Comparison of the GARCH Process of Ramadan and Christmas Effect on External Sector Variables (Malaysia, 2004-2013)

External Sector	<i>Export</i>	<i>Import</i>	<i>Exchange Rate</i>
Variables	<i>Merchandise Export Growth</i>	<i>Merchandise Import Growth</i>	<i>Exchange Rate Index</i>
Abbreviation	<i>EXP_{Malaysia}</i>	<i>IMP_{Malaysia}</i>	<i>EX_{Malaysia}</i>
Mean Equation (<i>Y</i> represents each variable)	$Y_t = \mu_0 + \sum_{i=1}^k \varphi_i Y_{t-i} + u_t, u_t = \sqrt{h_t} \varepsilon_t$		
<i>C</i>	0.074 (0.447)	0.498 (0.429)	2.234 (2.487)
<i>L</i> (1)	0.988*** (0.029)	0.933*** (0.026)	0.983*** (0.022)
<i>L</i> (2)	-	-	-
Variance Equation	$h_t = v_0 + \alpha_1 D_{RAMADAN} + \beta_1 D_{CHRISTMAS} + \sum_{i=1}^p \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j h_{t-j}$		
<i>C</i>	1.107 ⁺ (0.726)	0.266 (0.686)	1.731** (0.725)
γ	0.313** (0.144)	0.286** (0.137)	0.148 (0.161)
δ	0.440*** (0.132)	0.393** (0.161)	0.011 (0.277)
<i>D_{RAMADAN}</i>	6.233*** (1.844)	4.739*** (1.259)	1.742⁺ (1.131)
<i>D_{CHRISTMAS}</i>	2.548 (3.412)	9.695** (4.699)	-0.590 (0.639)
$\gamma + \delta$	0.753	0.679	0.159
<i>AIC</i>	5.477	5.297	3.812
<i>SIC</i>	5.643	5.463	3.988
<i>D-W</i>	0.819	0.840	1.350
<i>Adj. R²</i>	0.916	0.928	0.964
<i>Time Series</i>	2004.2-2013.9	2004.2-2013.9	2005.1-2013.10
Obs.	116	116	106

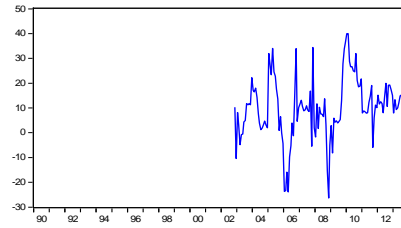
Notes: Significance levels are 15% ⁺, 10% ^{*}, 5% ^{**}, and 1% ^{***}. ε_t and h_t denote error terms and conditional standard deviation at time t , respectively. AIC is for Akaike Information criterion; SIC is for Schwarz Information Criterion; and D-W is for Durbin-Watson statistic.

APPENDIX 3 Time Series of Indonesia

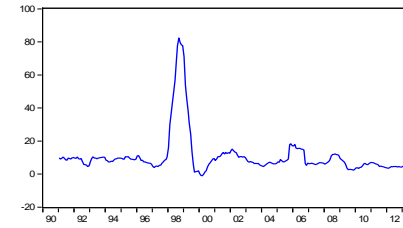
<Figure A.1> Industrial/Manufacturing Production Growth Rate (y-o-y, %)



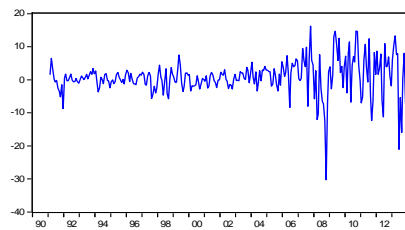
<Figure A.2> Retail Sales Growth Rate (y-o-y, %)



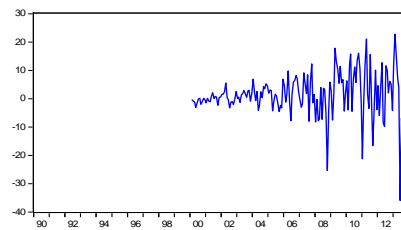
<Figure A.3> Inflation Rate (%)



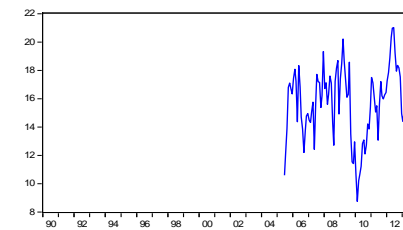
<Figure A.4> Composite Stock Price Index (monthly change)



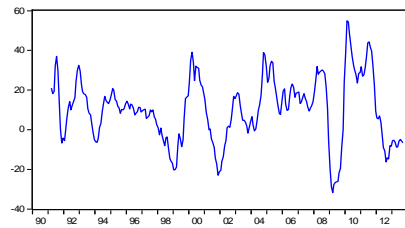
<Figure A.5> Financial Stock Price Index (monthly change)



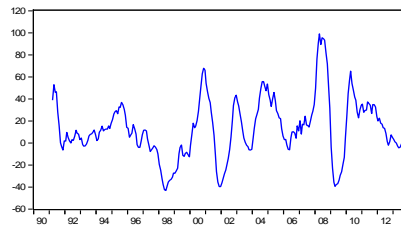
<Figure A.6> Growth of Broad Money (y-o-y, %)



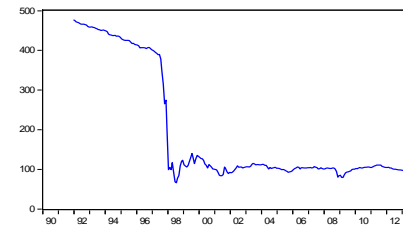
<Figure A.7> Merchandise Export Growth Rate (y-o-y, %)



<Figure A.8> Merchandise Import Growth Rate (y-o-y, %)

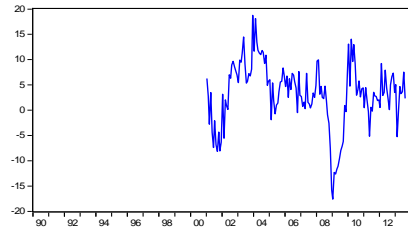


<Figure A.9> Exchange Rate Index (monthly average, January 2006=100)



APPENDIX 4 Time Series of Malaysia

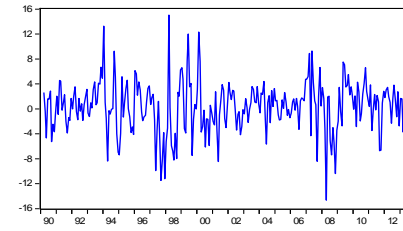
<Figure A.10> Industrial/Manufacturing Production Growth Rate (y-o-y, %)



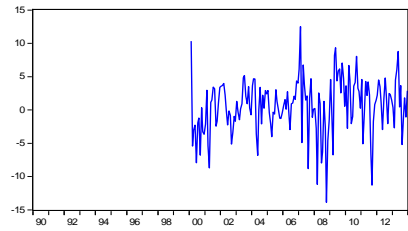
<Figure A.11> Inflation Rate (%)



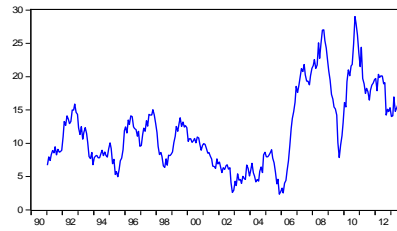
<Figure A.12> Composite Stock Price Index (monthly change)



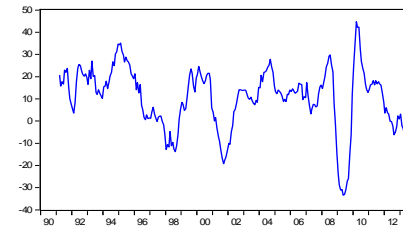
<Figure A.13> Financial Stock Price Index (monthly change)



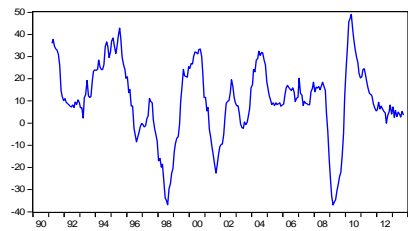
<Figure A.14> Growth of Broad Money (y-o-y, %)



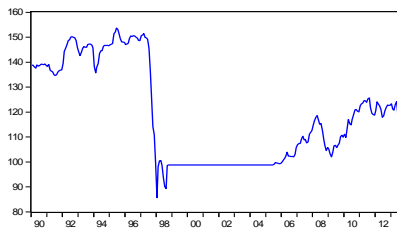
<Figure A.15> Merchandise Export Growth Rate (y-o-y, %)



<Figure A.16> Merchandise Import Growth Rate (y-o-y, %)



<Figure A.17> Exchange Rate Index (monthly average, January 2006=100)



REFERENCES

- Abu-Taleb, M. S., "The Influence of the Patterns of Consumption during Ramadan on a Family's Budget," *Alexandria Journal of Agricultural Research*, 48(3), 2003, pp. 35-59.
- Ahmed, Hussein, "Faith and Trade: The Market Stalls around the Anwar Mosque in Addis Ababa during Ramadan," *Journal of Muslim Minority Affairs*, 19(2), 1999, pp. 261-268.
- Engle, F. Robert, "Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation," *Econometrica*, 50, 1982, pp. 987-1006.
- Fam, S. Kim, Davis S. Waller, and Zafer B. Erdogan, "The Influence of Religion on Attitudes toward the Advertising of Controversial Products," *European Journal of Marketing*, 38(5/6), 2004, pp. 537-555.
- Fattah, M. Hassan, "The New Ramadan: It's Beginning to Look a Lot Like..." *The New York Times*, October 12, 2005.
- Gouriéroux, Christian, *ARCH Models and Financial Applications*, New York: Springer-Verlag, 1997.
- Kadri, Nadia, *et al.*, "Irritability during the Month of Ramadan," *Psychosomatic Medicine*, 62, 2000, pp. 280-285.
- Kang, Sang Hoon and Seong-Min Yoon, "Price and Volatility Transmission between ADRs and Their Underlying Stocks: Evidence from the Korean Case," *Korea and the World Economy*, 12(1), 2011, pp. 99-116.
- Karaagaoglu, Nilgun and Sevinc Yucecan, "Some Behavioural Changes Observed among Fasting Subjects, Their Nutritional Habits and Energy Expenditure in Ramadan," *International Journal of Food Sciences and Nutrition*, 51, 2000, pp. 125-134.
- Keenan, L. Kevin and Sultana Yeni, "Ramadan Advertising in Egypt: A Content Analysis with Elaboration on Select Items," *Journal of Media and Religion*, 2(2), 2003, pp. 109-117.

- Keng, A. Kau, Kwon Jung, Tan S. Jiuon, and Jochen Wirtz, "The Influence of Materialistic Inclination on Values, Life Satisfaction, and Aspirations Analysis," *Social Indicators Research*, 49, 2000, pp. 317-333.
- LaBarbera, Priscilla, "Consumer Behavior and Born again Christianity," *Research in Consumer Behaviour*, 2, 1987, pp. 193-222.
- Luqmani, Mushtag, Ugur Yavas, and Zahir Quraeshi, "Advertising in Saudi Arabia: Content and Regulation," *International Journal of Advertising*, 6(1), 1987, pp. 59-71.
- McDaniel, W. Stephen and John J. Burnett, "Consumer Religiosity and Retail Store Evaluative Criteria," *Journal of the Academy of Marketing Science*, 18(2), 1990, pp. 101-112.
- Mitchell, Paul and Mohammed Al-Mossawi, "Religious Commitment Related to Message Contentiousness," *International Journal of Advertising*, 18, 1999, pp. 427-443.
- Noh, Jaesun and Alex Kane, "Forecasting Volatility and Option Prices of the S&P 500 Index," *Journal of Derivatives*, 1, 1994, pp. 17-30.
- Odabasi, Yavuz and Argan Metin, "Aspects of Underlying Ramadan Consumption Patterns in Turkey," *Journal of International Consumer Marketing*, 21, 2009, pp. 203-218.
- Pagan, Adrian, "Econometric Issues in the Analysis of Regressions with Generated Regressors," *International Economic Review*, 25(1), 1984, pp. 221-247.
- Park, Jin Kyu, "'Creating My Own Cultural and Spiritual Bubble': Case of Cultural Consumption by Spiritual Seeker Anime Fans," *Culture and Religion*, 6(3), 2005, pp. 393-413.
- Park, Z. Jerry and Joseph Baker, "What Would Jesus Buy: American Consumption of Religious and Spiritual Material Goods," *Journal for the Scientific Study of Religion*, 46(4), 2007, pp. 501-517.
- Rippin, Andrew, *Muslims: Their Religious Beliefs and Practices*, Vol. 2: *The Contemporary Period*, London: Routledge, 1993.
- Roky, Rachida, *et al.*, "Physiological and Chronobiological Changes during

- Ramadan Intermittent Fasting,” *Annals of Nutrition & Metabolism*, 48(4), 2004, pp. 296-303.
- Saeed, Mohammad, Zafar U. Ahmed, and Syeda-Masooda Mukhtar, “International Marketing Ethics from an Islamic Perspective: A Value-Maximization Approach,” *Journal of Business Ethics*, 32(2), 2001, pp. 127-142.
- Salman, Farhan and Aslihan Salih, “Modeling the Volatility in the Central Bank Reserves,” Central Bank of the Republic of Turkey Working Paper, Dec. 1999.
- Sandikci, Ozlem and Sahver Omeraki, “Islam in the Marketplace: Does Ramadan Turn into Christmas?,” *Advances in Consumer Research*, 34, Accepted Paper Series, Retrieved June 29, 2007 (<http://papers.ssrn.com/sol3/papers.cfm?abstractid=920362#>).
- Seyyed, J. Fazal, Abraham Abraham, and Mohsen Al-Hajji, “Seasonality in Stock Returns and Volatility: The Ramadan Effect,” *Research in International Business and Finance*, 19, 2005, pp. 374-383.
- Toda, Masahiro and Kanehisa Morimoto, “Ramadan Fasting-Effect on Healthy Muslims,” *Social Behavior and Personality*, 32(1), 2004, pp. 13-18.
- Uppal, J. S., “Hinduism and Economic Development in South Asia,” *International Journal of Social Economics*, 13(3), 1986, pp. 20-23.
- Zainul, Norazlina, Fauziah Osman, and Siti H. Mazlan, “E-Commerce from an Islamic Perspective,” *Electronic Commerce Research and Applications*, 3, 2004, pp. 280-293.
- Zinbarg, D. Edward, *Faith, Morals and Money: What the World’s Religions Tell Us about Ethics in the Marketplace*, London: Continuum International Publishing Group, 2005.