Does Malaysian Islamic Money Market Efficiently Predict Inflation in the Future? Evidence from Fisher Effect Theory

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Fisher theory explains relationship between interest rate and expected inflation rate that indicates market efficiency. In Malaysia, the Islamic money market has gained importance since its own largest composition in Malaysian financial market. This study attempts to examine the existence of Fisher Effect relationship in Malaysian Islamic Money Market. Period of the time series data spanning from 2010 to 2017. Three variables include in this paper which are Inflation Rate (INF), 3-months Malaysian Islamic Treasury Bills Rate (MITB) and Islamic Interbank Rate (IIR). First stage of analysis is to examine the existence of the Fisher effect relationship by applying Autoregressive Distributed Lag (ARDL) approach as an estimation method. Second stage analysis is to determine the Fisher Effect relationship appear in a weak or strong form relationship. The findings suggest the Fisher Effect theory exists in Malaysian Islamic money market thus implies the efficiency of Islamic Money Market to predict inflation's movement in the future. However, it appears in a weak form of relationship. Overall, the outcome of this study is highly benefit to policy maker as the role of Fisher Effect in predicting inflation reflect an effective monetary policy to promote economy growth and sustainable development.

I. INTRODUCTION

1.1 Background

Much of empirical research have concern on the movement between inflation rate and interest rate in the context of Fisher theory proposed by Irving Fisher (1930). Fisher theory implies interest rates is move one for one with the estimated inflation rate thus to forms a foundation of interest rates theory. Additionally, Fisher theory also suggested real rate is persistent for the reason of not influenced by the movement in money supply and inflation rate (Carneiro *et al.,* 2002). In general, role of real interest rate is very important as they determine investment and saving activities of businesses and households therefore direct to the economy growth and development (Nusair, 2009).

Nominal interest rate is defined as price borrower need to pay for temporary usage of capital and inflation rate explain the reflection of the continuous increase in prices of services and goods in economy for a specific time period , which on the other hand it measures purchasing power of money (Obi *et al.,* 2009). Large volatile in the interest rate and inflation rate has caught a main concern from policymakers and government. Basically, the government as appointed monetary authority will consider the movement of inflation as imply in Fisher Effect theory in order to formulate effective monetary policy through money supply adjustment in the financial market. Ito (1999) explain a situation when interest rates move with direction of expected inflation rate thus indicates effectiveness of monetary policy. Therefore, understanding the interest-inflation relationship in the Fisher Effect theory is essential among the economists.

An investigation on Fisher Effect relationship has been broadly conducted in developed and emerging countries. Study from Darby (1975) reject the Fisher Effect theory when he found the burden on interest income tax lead to rise in interest rates more than one for every increase in inflation rate. This is similar to the study from Weidmann (1997) where he re-investigated the Fisher relationship in Germany and the result reveals no evidence of Fisher Effect when interest rate does not reflect with changes in inflation rate. In contrast with Panpoulou (2005), he discovered full fisher effect exist in 14 OECD countries when the interest ratee move one-for-one with the inflation rate. The study of Fisher relationship also has been tested regularly in developing and developed countries. Following to Saadet *et al.,* (2006), the evidence of Fisher Effect only can be support when they use a fractional integration in data analysis. Lee (2007) investigate the existence of Fisher relationship in Singapore and the result appear a positive relationship between nominal interest rate and inflation rate but fail to support the evidence of a full fisher effect. Moreover, the study from Berument and Nergiz (2005) suggest the Fisher Effect holds in G7 countries but fail to find any evidence in majority of developing countries. Based on Awomuse and Alimi (2012), the result explain interest rates is move together in the long run with inflation rate but does not support a full fisher basis in Nigeria.

In Malaysia, the role of Fisher Effect on the volatility in inflation have been debated among the economists over a long period (Hawati *et al.,* 2010). Following to Geetha *et al.* (2011), they

investigate the validity of Fisher relationship within a stock market in China, Malaysia and US. The result supports the validity of Fisher Effect when the long run relationship appears in stock returns and inflation rate in all countries. Furthermore, Asari *et al.,* (2011) attempt to find evidence of Fisher effect within Malaysian exchange market and the result fail to found Fisher relationship since it appears negative correlation between inflation rate and exchange rate. In recent, the present of Fisher Effect also has been tested in Malaysian capital market. Fah and Annuar (2012) reveals the existence of Fisher Effect in capital market when they found long-run cointegration between the returns on Malaysian Government Security and Gross Domestic Product (GDP) deflator.

Islamic money market in Malaysia has been establish in early 2000's and since then it shows a rapid growth and dynamic progress within an Islamic banking sector. This condition can be demonstrated when huge amount of capital from Islamic money market has been pumped in the market. Figure 1 depicts conventional and Islamic money market transaction in Malaysia.
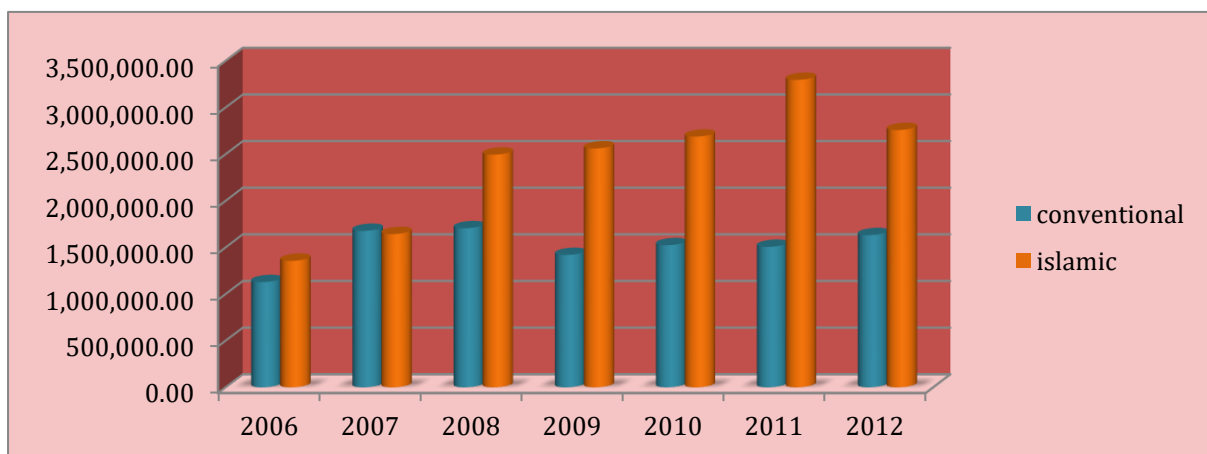

Source: Bank Negara Malaysia

Figure 1: Volume of Conventional and Islamic Money Market

Based on Figure 1, in 2006 and 2007 can be seen as both conventional and Islamic markets are highly competitive among each other. Afterwards, it shows the Islamic market own a large portion of volume transaction thus leaving the conventional market with a stagnant transaction. This condition resulted from increasing demand by local and global investor especially in Islamic products and supportive policy environment that contribute Islamic money market that turn into major parts in Malaysian Financial Market.

Current volatile economic condition in global financial markets brings a difficult condition in Malaysian economic and financial system as they have been burdened by damaging external forces. In 2008, the financial crisis which originated from the United States (US) has reflect the fragility of world economy. Likewise, an unexpected event from the collapse of subprime mortgage crisis in 2007 was the starting point where the US economy begin to shrink sharply. Afterwards, this condition has sent ripples across Asian economies that cause panic and

financial turmoil among the Asian countries. As the world economic leads towards a global financial crisis, Malaysian economic is not to be exempted. Munir and Mansur (2009) mentioned the crisis has raise the inflation to the maximum level at 8.5 percent as well as recession to the Malaysian economic in 2008.
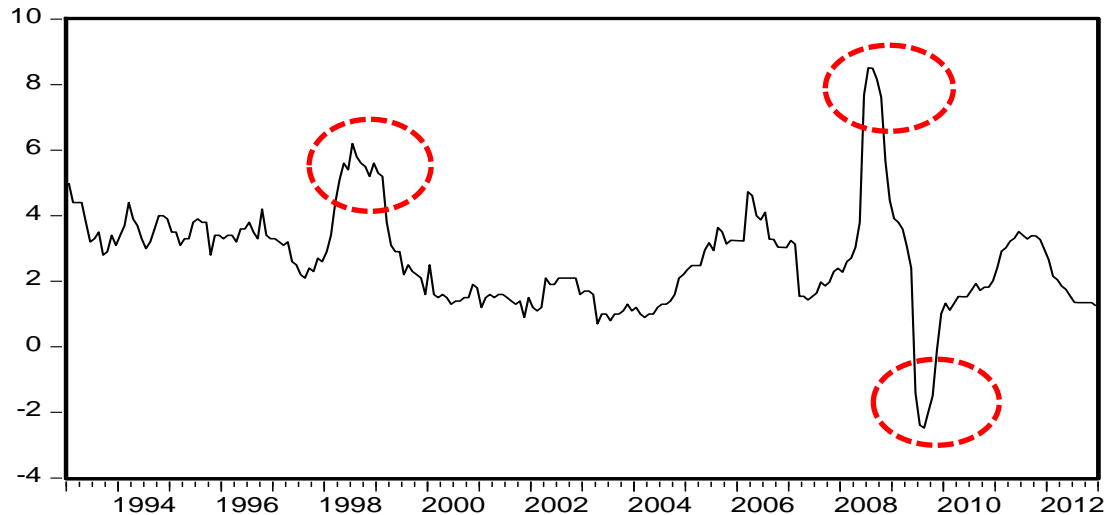
Source: Department of Statistic Malaysia

Figure 2: Inflation in Malaysia

According to Figure 2, Malaysian inflation rate record as highly volatile particularly during unfavourable economic event. In 1998 and 2008, inflation rate extremely spikes to the highest as a reflection to the global financial crisis (Fatima and Sahibzada, 2012). In particular, Munir and Mansor (2009) report inflation rate rise to 5.3 percent in 1998 from 2.7 percent in 1997 is mainly cause by Asian financial crisis during 1997. This condition has results Malaysian economy suffered a sharp decline in the growth of GDP that equal to -7.4 percent in 1997. When the inflation rose at peak it not only provides a negative consequence to the country, though it brings pressure to pensioners, investors and household owed to the loss value in currency. Furthermore, based on the Economic Report 1999 from Ministry of Finance, it discloses rate of unemployment reach the lowest in 1997. However, large depreciation in value of Ringgit Malaysia has push the unemployment rate to reach 3.2 percent in 1998 as compared to previous 2.7 percent in 1997.

Motivation of the study is various evidence has proven the validity of Fisher Effect among Islamic countries result from the Islamic financial market is rapidly develop across the world. Few studies (Alsmadi and Almsafir, 2013; Ahmad, 2010; Gul and Acikalin, 2008; Fatima and Sahibzada, 2012 and Mahdi and Masood, 2011) have investigate the existence of Fisher Effect theory in Jordan, Turkey, Saudi Arabia, Pakistan and Iran. The result is quiet surprise when majority of them has found the existence of Fisher relationship thus indicates the ability of interest rates in Islamic market as a predictor of future inflation.

Banking system in Malaysia has devoted Malaysia as a unique country where Islamic market operates in parallel with the conventional. Limited study has found to examine the existence of

Fisher Effect between interest rate and expected inflation rate mainly in Malaysian Islamic market. A main difference between Islamic market and conventional market are they are applying different principles as in Islamic market, Shariah principle are the core to run the business activities. In addition to this, the Islamic market also are prohibited from activities such as uncertainty (gharar), gambling (maisir) and interest (riba) elements and the capitals are strictly controlled from dealing in non-halal activities. This is contrast with the conventional where there is no restriction for any kind of investment activities. Following to this gap, the interest rate and inflation rate among Islamic market and conventional market could move differently. The outcomes from this study may provide solution on research question below:

"Is the Islamic money market in Malaysia efficient to predict inflation in future?"

1.2 Objective

This study attempts to examine the validity of Fisher Effect relationship in Malaysian Islamic Money Market as the first objective. Second, to ascertain one-for-one relationship between interest and inflation rates as suggested by the theory of Fisher Effect. Section 2 presents an overview of the existing theoretical and empirical literature on the relationship between interest rate and inflation rate mainly from the perspective of Fisher Effect theory. Section 3 discusses the estimation method and estimation model undertake to achieve objectives of the study. In section 4 we reveal the findings of the empirical investigation on the validity of Fisher Effect relationship in Malaysian Islamic Money Market. Section 5 deliver a conclusions and summaries.

II. LITERATURE REVIEW

2.1 Background Theory

Irving Fisher (1930) is the pioneer who developed a theory that explain interaction between nominal interest rate and inflation rate namely Fisher Effect theory. He proposed the theory of Fisher Effect consist of three components; 1) nominal interest rate; 2) expected inflation rate and 3) real interest rate. He also suggested the real interest rate will remain constant while the movement in inflation rate is reflected from the variation in nominal interest rate. However, the real interest rate is not remained constant forever. Study from Nusair (2009) describes the condition of real interest rates is influence by real economic issues like investor's time preference and capital productivity.

The theoretical equation in the theory of Fisher Effect suggested the nominal interest rate is built from the two economic variables which are the real rate interest rate and the expected inflation rate

Nominal interest rate $i_t = R_t + \beta \pi_t^e + \varepsilon_t$ …………………………………………. (1)

Firstly, nominal interest rate is defined as the value debtor need to pay for a temporary usage of fund borrowed (Obi *et al.,* 2009). Usually when the situation of interest rate reach to high level, this will bring unfavorable condition to the debtor as the cost of borrowing has increase, whereas the low interest rate bring the favor among the debtors since it reduces the borrowing cost. Furthermore, according to Deutche Bundesbank (2001) interest rates are determined from capital market's supply and demand in equilibrium. Secondly, the real interest rate generally expresses as a determinant of investment and saving behavior among businesses and households and it provides a significant impact to the development and growth of an economy. The study from Hakan and Kamuran (2000) mention the main concern among firms and households is the variation of real return on asset holding. The real interest rate differs from nominal interest rate since its persistence to inflation. Thirdly, inflation rate explains the condition rise in prices of services and goods in the economy for specific period of time or in other words it is known as the indicator of value of money. When inflation spike up, production, balance of payments, aggregate demand and trade deficits will decline. On the other hand, supportive environment on economic activities derive moderate and low inflation rate which contribute to reduce rate of unemployment, ease balance of payment problem and increase in GDP (Obi *et al.,* 2009).

Based on Hawtrey (1997) several number of justifications as why the Fisher theory preserved as a key element in economic literature. First, the pivotal role of real interest rate in country's investments, economic growth and savings and at the same time influencing trade and capital flows via exchange rate. Second, as indicated by Fama (1975), there is large numbers of literature to conclude the interest rates as a predictor of future inflation rate. Third, central bank deems the Fisher relationship as a significant factor for monetary policy implementation.

2.2 Review from Literature

To gain a better understanding, a comprehensive review of the literature mainly on the study of Fisher Effect is discuss in this chapter. The research from Atkins (1989), Crowder and Hoffman (1996) as well as Evans and Lewis (1995) found evidence of the Fisher Effect by including after-tax interest rates in data analysis. The study from Atkins (1989) and Evans and Lewis (1995) find the existence of long-run Fisher Effect in the United States by applying various method of cointegration approach. By using different methodology, the study from Crowder and Hoffman (1996) indicate after-tax interest rate is fully reflected to the movements in inflation rate thus support the Fisher Effect theory.

On the other hand, many studies support the existence of Fisher relationship after the event of financial deregulation. Olekalns (1996) and Hawtrey (1997) strongly supported the evidence of Fisher Effect in Australia. Earlier to the financial deregulation, the study from Olekalns (1996) only found a partial adjustment between interest rate and expected inflation rate. However, this condition shift to fully adjusted after the financial deregulation and the author mentions owing to shock in money supply that reflect real interest rate has been the reason on the adjustment is not complete before to deregulation. This is similar with Hawtrey (1997) that

found the validity of Fisher relationship by applying Johansen Juselius cointegration approach for post financial deregulation.

In contrast, few researchers unable to support evidence of Fisher relationship in their country studies. The study from Dutt and Ghosh (1995) examine correlation under the regimes of fixed and floating exchange rate. The result indicates no supporting evidence of the present of Fisher relationship for both regimes. This is constant with findings from Junttila (2001) where she does not find any validity in Fisher Effect theory in Finland. Furthermore, the Fisher relationship in United Kingdom provide insignificant relationship among inflation rate and interest rate (Evans, 1998). Fahmy and Kandil (2003) examined the present Fisher Effect theory between return on US Treasury security and commercial paper and the inflation rate for the period 1980 to 1997. The findings only show the existence of long-run Fisher Effect however in the short-run, no significant relationship was supported.

 Malaysia is the one among emerging country that progress rapid development in the growth of economy. The variation among interest rate and inflation rate has been explained by Irving Fisher (1930) is still under investigation. Most of the researchers that examined Fisher Effect in Malaysia deliver a varies findings. Initial research on Fisher Effect in Malaysia was completed by Annuar *et al.,* (1987). This research includes 3 months treasury bill rate to proxy interest rate and the result suggest no basis to include short-term interest rate to predict future inflation rate. Furthermore, Fah and Annuar (2012) examine the existence of Fisher relationship in Malaysian bond market. Quarterly data used provide a finding that describes a movement between Malaysian Government Security (MGS) and GDP deflator in the long run. The authors expand the finding with Granger causality test and found the unidirectional relationship between the MGS spreads and GDP deflator.

Kasman and Turgutlu (2006) in their study found for conventional unit root test, no cointegration has been detect among interest rates and inflation rate. They argue in assessing the Fisher relationship, fractionally cointegrated structure might be more appropriate. This is cause by disturbance term will respond to shocks slower than classical cointegration structure. From the findings, equilibrium errors might move as fractionally integrated series, indicating slow mean reversion. The finding also discloses most of the countries are fractionally integrated except for Malaysia that is not fractionally integrated.

The correlation between stock return and inflation rate has been widely studied in Malaysia (Hawati *et al,.*2010 and Geetha et al., 2011). Hawati *et al*. (2010) has found the present of the Fisher relationship in the Malaysian stock market. The study illustrates the significant sources on the movement in inflation is from the direction of stock returns after control by industrial production and money supply. Moreover, the study from Geetha *et al.,* (2011) examined the correlation between stock returns and inflation rate in China, Malaysia and United States. Their result exposes long run relationship appears between unexpected and expected inflation with stock returns in majorities of the countries while short run relationship is supported only in China.

Asari *et al.* (2011) has explore the Fisher relationship within Malaysian exchange market. They study the movement among exchange rate, inflation rate and interest rate in Malaysia starting from 1999 until 2009. The findings found the interest rate is positively correlated with inflation rate in the long run thus support the existence of Fisher Effect theory. Unfortunately, the study also reveals no evidence of Fisher Effect in exchange market since exchange rate responds negatively with inflation rate.

In the twenty-first century, the Islamic market has showing a vast development as they provide an alternative for conventional counterpart. Among them, Turkey, Pakistan, Kuwait, Iran, Saudi Arabia and Egypt own the largest market share in Islamic markets in the world. This condition gives initiative to many scholars to examine the effectiveness of Islamic market to predict future inflation. This is including the study of Fisher relationship has largely been tested in Islamic countries. Overall, the findings are quite surprising where majorities reveal the evidence of Fisher Effect theory.

The recent evidence of the validity of Fisher relationship in Islamic countries was supported in Jordan. Based on Alsmadi & Almsafir (2013), they study the effects from macroeconomic condition which is inflation rate on conventional interest rate and Murabahah (Islamic rate). The findings describe the effect of inflation rate on Murabahah is significant and contrast with conventional interest rate where no significant relationship has been found. The study summarizes that Islamic market reach equilibrium faster than conventional. Within same year, Al-Sharkas & Al-Zoubi (2013) estimate the relationship between price index that proxy for inflation and stock price among four major Arab countries which started from 2000-2009 by undertaking Johansen Juselius cointegration approach as estimation method. The outcome from this study support the Fisher Effect relationship for all countries exclude for Kuwait.

The study from Fatima and Sahibzada (2012) find the validity of Fisher relationship by applying error correction model and Johansen Juselius cointegration approach. In addition to this, the study proceeds to determine directional relationship by using granger causality test and variance decomposition model is used to explain the error correction model. The findings show the existence of Fisher Effect in Pakistan. While in Turkey, Gul and Acikalin (2008) and Gul and Ekinci (2006) use Johansen Juselius approach to examine the Fisher relationship. The long run stable relationship between interest rate and expected rate of inflation has been found in the research findings.

Ahmad (2010) study the Fisher relationship in four main countries in South Asia namely Saudi Arabia, India, Pakistan, Kuwait, Sri Lanka, and Bangladesh. By applying ARDL estimation approach, the result shows the existence of weak form Fisher Effect relationship in India, Saudi Arabia, Kuwait and Pakistan. Nonetheless no evidence of Fisher relationship has been found for Bangladesh and Sri Lanka.

The evidence of Fisher Effect in Iran has been found by Mahdi & Masood (2011). For this purpose, they implement Vector Error Correction Model and Johansen Juselius cointegration to examine the long-run cointegration between the interest rate and inflation rate. The findings

reveal the Fisher relationship appear in weak form and this is due to the expected interest rate on facilities is not a market forces driven.

Moreover, the study from Nezhad and Zarea (2007) apply Toda and Yamamoto's Granger causality test as well as Autoregressive Distributed Lag approach to assess the validity of Fisher relationship in Iran. The findings suggest non-official and official interest rates are granger cause the inflation rate, but the relationship is not vice versa.

To summarise the above literature, several research gaps has been found in this study. Generally, many studies have found to valid the Fisher relationship in Islamic countries. While for Malaysia, the banking system is unique where it permits to operate in dual banking system in which Islamic banking operates in parallel with Conventional banking system. From the literature we have found there is paucity studies in examining the movement between interest rate and inflation rate as to valid the Fisher Effect theory particularly in Islamic Money Market in Malaysia. The present study therefore aims to bridge the gap in the literature by bringing new empirical evidence on the existence of Fisher Effect relationship in Malaysian Islamic Money Market

III. METHODOLOGY

3.1 Data Collection

Data in this study consist of monthly time series data covering period of 8 years starting from January 2010 until December 2017. Each variable is taken from secondary data on Bank Negara Malaysia's annual report. The data on the Islamic Interbank Rate (IIR) and 3-months Malaysian Islamic Treasury Bills Rate (MITB) has been chosen to proxy the interest rate in Islamic market whereas for inflation rate, Consumer Price Index (CPI) has been included in this study. In general, the CPI often gauge for the period of inflation and deflation. Study from Ur *et al.,(*2004) suggest in the short run, rise in CPI denotes phase of inflation while drops in CPI is a sign for the phase of deflation.

3.2 First Stage – Autoregressive Distributed Lag (ARDL) Cointegration Approach

The present study proposes the ARDL cointegration approach to assess the validity of Fisher relationship in Malaysian Islamic Money Market in the first stage analysis. Pesaran and Shin (1999) initiate the ARDL bounds cointegration approach and later being extended by Pesaran *et al.* (2001). The ARDL approach is most recent cointegration technique after the Johansen Juselius (Johansen and Juselius, 1990) and Eagle Granger (Engle and Granger, 1987) approaches. Main benefit of ARDL approach is it allows separate order of integration and does not restrict the same order of integration among the variables. This condition is certainly appropriate for those variables that might own fractional order of integration (Pesaran and Shin 1999). Likewise, this method is more suitable for two or more variables in a small sample size to identify the long-run relationship as compared to Engle and Granger's (1987) and Johansen and Juselius (1990) approaches. Other than that, Pesaran and Shin (1999) mention the ARDL

framework produce super-consistent long-run coefficients estimators. In fact, many studies have been proven to validate the Fisher relationship by employing ARDL methodology.

It is essential to check the stationarity for all variables to determine the integration order before continuing with the ARDL bounds test. In previous, there is a large argument on the literature that claim ARDL approach is not necessary for pre-testing the stationarity to identify the order of integration. However, according to Alimi and Ofonyelu (2013) the prior test is important for model under the ARDL framework as to ensure no variables are integrated of order $I(2)$. Following to Ouattara (2004), any variable with the presence of $I(2)$ leads to the invalid computed F-statistics as the critical values under bounds test proposed by Pesaran *et al.* (2001) is cover on the hypothesis that have variables range from $I(0)$ or $I(1)$. Therefore, the prior checking of unit root tests in conducting the ARDL approach is needed to confirm no variable is integrated of order 2 or above.

Next step is to proceed with ARDL bounds test methodology as propose by Pesaran *et al.,* (2001) to examine the validity of long-run relationship among the interest rate and inflation rate. Below depict the ARDL (p, q) model used to estimate the long run relationship between the variables:

$$\mathrm{D}i_t = c + b_1 i_{t-1} + b_2 x_{t-1} + \sum_{j=1}^{p-1} f_i \mathrm{D}i_{t-i} + \sum_{i=1}^{q-1} y \mathrm{D}x_{t-i} + f \mathrm{D}x_t + e_t \quad \ldots\ldots\ldots\ldots\ldots\ldots..(2)$$

Where, Δ denotes the first difference operator, i_t = interest rate (IIR_t and $MITB_t$); x_t = inflation rate (INF_t) and (ε_t) represents white noise error term. On the other hand, p and q are the autoregressive lag orders of the independent and dependent variables.

To estimate long run cointegration in equation (2) can be assessed by using ordinary least squares and *F-statistics*. A Schwarz Bayesian Criterion (SBC) has been employed for the selection of optimal lag length. According to Pesaran *et al,*.2001, the critical values of this test valid under two conditions, *i.e.* when all variable are stationary at *I(0)* and *I(1)*. The critical value consists two sets of upper and lower bounds. Alternate hypothesis is supported if the computed F-statistics fall above the upper bound, thus infers the validity of long-run relationship among the inflation rate and interest rate. Meanwhile, if the computed F-statistic fall below the lower bound, the null hypothesis is valid, and this imply no validity of Fisher relationship. Moreover, if the computed F-statistics fall in these bounds, the result remain indecisive.

In addition to this, the study from Bahmani and Gelan (2006) suggest is the alternative option to detect long-run relationship in model estimation is by providing a significance lagged of Error Correction Model (ECM_{t-1}). They propose a negative and significant value of ECM_{t-1} indicates the existence of long run cointegration thus support the validity of Fisher relationship. The coefficient on ECM_{t-1} also indicates the pace among interest rates and inflation rate to achieve their long-run equilibrium.

3.3 Second Stage - The Coefficients of Fisher Relationship

The long run cointegration between interest rate and inflation rate that valid Fisher relationship has been achieved in the first stage, the second stage of analysis is to determine one-to-one relationship between interest rate and inflation rate as proposed by the theory of Fisher Effect. Generally, the long-run relationship between the variables provide the evidence of validity Fisher Effect theory. However, the theory suggest it is not relying on the existence of long-run relationship, but it is necessary the interest rate to move one-to-one with inflation rate (Atkins and Coe, 2002). There are two conditions in Fisher relationship which are strong and weak form of Fisher Effect. The strength of Fisher relationship is indicated from the value of β given in equation (1). Atkins and Coe (2002) also suggest detecting one-to-one relationship among interest rate and inflation rate, the restriction $\beta = 1$ on the cointegration regression model must be impose. This hypothesis can be tested by using standard asymptotic chi-square in Wald tests and denotes $\beta = 1$ indicates a strong form of Fisher relationship.

IV. RESULTS AND ANALYSIS

Prior to the ARDL bounds test, it is essential to determine the order of integration for all variables. Table 1 reports the unit root tests under Phillips-Perron and Augmented Dickey Fuller tests.

Table 1: Augmented Dickey-Fuller and Phillip-Perron unit root test results

	ADF		Phillip-Perron	
	Level			
	Intercept	Intercept and trend	Intercept	Intercept and trend
INF	-3.7621(11)***	-3.8112(11)***	-3.3765**	-3.2216**
MITB	-1.8991(11)	-1.989(11)	-2.4152	-2.5016
IIR	-1.9223(11)	-1.8922(11)	-1.6231	-1.7979
	First Different			
INF	-6.4776(11)***	-6.3231(11)***	-4.9603***	-4.9010***
MITB	-8.1002(11)***	-8.0226(11)***	-8.2134***	-8.1821***
IIR	-6.2055(11)***	-6.2100 (11)***	-6.2096***	-6.2105***

Notes: *, **, *** denotes 10%, 5% and 1% significance levels respectively

As indicated in Table 1, none of the variables are stationary at an order more than one *I*(1) and this condition permits us to proceed with the ARDL bounds techniques. The stationarity of each variables is necessary to confirm no variables are integrated of order *I*(2) as this condition will provide invalid result (Alimi and Ofonyelu, 2013).

4.1 The ARDL Long-run Cointegration Approach

After checking the stationarity, next is to examine the long run relationship between interest rate and inflation rate by employing the ARDL bounds test Pesaran and Shin, 1996, 1995). Below depicts is the general model to explain the long run relationship between interest rate and inflation rate in Malaysia Islamic Money Market.

$$\Delta MITB_t = c + \beta_1 MITB_{t-1} + \beta_2 INF_{t-1} + \sum_{i=1}^{p} \alpha_{1i} \Delta MITB_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \Delta INF_{t-i} + \varepsilon_t \qquad (3)$$

$$\Delta IIR_t = c + \beta_1 IIR_{t-1} + \beta_2 INF_{t-1} + \sum_{i=1}^{p} \alpha_{1i} \Delta IIR_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \Delta INF_{t-i} + \varepsilon_t \qquad (4)$$

For some condition, both criteria select the similar number of lag order for the conditional ECM in equation (2). The estimation results are described in Table 2 below:

Table 2: Estimated Results for the Existence of long run Cointegration Relationship

Interest rates	*F-statistic*	SBC (p,q)	ECM_{t-1}	*p-value*
$MITB_t$	7.234**	(12,6)	-0.062	0.072
IIR_t	8.812***	(12,12)	-0.031	0.036

Notes: *, **, *** denotes 10%, 5% and 1% significance levels respectively.

Critical Value	Lower Bound	Upper Bound
1% significance level	6.84	7.84
5% significance level	4.90	5.73
10% significance level	4.04	4.78
Null Hypothesis: No Cointegration		

Table 3: Critical Values for ARDL Bounds Test

Notes: The Critical Value Developed by Pesaran et al. (2001) Under Case III: Unrestricted Intercepts; No Trends

According to Tables 2 and 3 above, it clearly seen that the computed *F-statistics* for $MITB_t$ and IIR_t fall above the upper bound and significant at 5% and 1% presenting the cointegration relationship between interest rate and inflation rate. The result also indicates the null hypothesis of no cointegration among interest rate and inflation rate has been rejected. Next is to check the significant of ECM_{t-1} for long-run cointegration among the variables. The results reveal the coefficient of ECM_{t-1} for $MITB_t$ and IIR_t is negative and significant thus we can infer the existence of cointegration in the long run, which indicates the validity of Fisher Effect theory is supported in Malaysian Islamic Money Market. The existence of Fisher Effect theory might possibly due to the conservative nature of Shariah principle in investment activities offer investors an alternative investment channel. The Islamic market that has been known as an

ethics filter investment basically prohibit all investment activities from interest (riba), uncertainty (gharar) and gambling (maisir). Based on this basic of Shariah principles, the Islamic Market is efficient to predict future inflation when the validity of Fisher Effect relationship has been supported. Besides that, the study from Ho *et al.,* (2013) explain Malaysia operates in dual banking system (conventional and Islamic) where the operation of Islamic market which is to filter all the activities in conventional following to ethical considerations to be considered as ethically acceptable. This result provides a similar finding with the study from Alsmadi and Almsafir (2013), Al-Sharkas and Al-Zoubi (2013), Fatima and Sahibzada (2012) and Ur *et al.,* (2007) when they found large evidence of Fisher relationship in Islamic countries. This indicates Malaysian Islamic Money Market rates is efficient to predict inflation in the future.

4.2 The Coefficient of Fisher Effect Theory

After the long-run cointegration in $MITB_t$ and IBR_t has been recognised in the previous result, next is to proceed with one-for-one movement among the inflation rate and interest rate in its strictest form as proposed by in Fisher Effect theory (Ahmad, 2010).

Table 4: The Coefficient of Fisher Relationship

Variables	Chi-Square
MITB	17070.5 (0.000)
IIR	17684.8 (0.000)

Notes: p-value in the parentheses (…) shows the probability of chi-square.

Null hypothesis of H_0: $\beta = 1$ is tested in order to determine the strong form of Fisher relationship. Based on Table 4, the $MITB_t$ and IBR_t show the p-value is significant at 1 percent indicates the rejection of the null hypothesis of strong form Fisher Effect. Overall, we support the alternate hypothesis indicating the present of Fisher relationship in Malaysian Islamic Money Market exists in the weak form of relationship. The findings are constant with Holod (2000) as he reveals the weak form of Fisher Effect in Ukraine. He also suggests the spike of inflation affect the movement in interest rate very slowly.

4.3 Diagnostic Test

In addition, both model regressions (*MITB* and *IIR*) have undergone the diagnostic test such as Lagrange Multiplier (LM) and Cumulative Sum Recursive Residuals (CUSUM) test to ensure the model has no serial correlation problem and dynamically stable. For both models, the LM test indicates that no serial correlation problem exists (p-value is greater than 0.05). While for CUSUM tests, it shows the stability test is within the bounds and significant at 5% level. This condition suggests the model is dynamically stable to validate all the results.

V. CONCLUSION AND RECOMMENDATION

This study examines the existence of the Fisher Effect relationship by evaluating the relationship among interest rate and inflation rate in Malaysian Islamic Money Market. To achieve the objective, the present study applies the ARDL cointegration approach initiated by Pesaran *et al.* (2001) in the first stage analysis. The results reveal a significant long run cointegration between inflation and interest rates thus support the validity of Fisher Effect relationship in Malaysian Islamic Money Market. However, in the second stage of analysis, the one-to-one relation between the inflation rate and the interest rate that has been suggested in the strict form of Fisher effect is not found.

The important issue needs to emphasis from the findings, even though Malaysian Islamic Money Market support the evidence of Fisher Effect, but the relationship exists in a weak form. This indicates Malaysian Islamic Money Market is efficient in the adjustment between interest rate and inflation rate in Malaysia however the effect is not obvious. The existence of Fisher relationship might possibly due to the conservative element of Shariah compliant that provide better investment alternative for investors. For this reason, the movement between inflation rate and interest rate particularly in Islamic market could behave differently with the conventional market. It is very exciting to highlight which there was huge attraction investment in Shariah compliant with the reason of their nature of profit-sharing and more equitable in investment activities. Moreover, in the case Malaysia, a large amount of fund has been pumped in Islamic money market be due to the continues efforts from a government to enhance the Islamic finance sector as well as to support Malaysia become a major hub for international Islamic finance.

The empirical findings from this study could be useful and deliver significant implications for a government and policymaker. The government or policymaker could use the direction of the Fisher Effect relationship as a guidance to implement an effective monetary policy for a sustainable growth in economic development. Moreover, the outcome from this study will benefit to investors and depositors since the role of interest rate as a predictor for future inflation (Ho *et al.,* 2013). In the event of unstable interest rates, the investors and depositors may adjust their portfolios by investing to other assets that hedge against inflation as the alternative for investment.

There are several limitations in conducting this research study. First, the scope of analysis in this study only investigates the Fisher relationship in Malaysian Islamic Money Market. Future studies will benefit to further investigate in other market for example bond and equity, as they are also equipped with Islamic market instruments. Second, this study runs the estimation only in Malaysia. There are several countries that operate in dual banking system such as Indonesia. Therefore, future study may look forward to examining the relationship in any other country that own similar banking system as Malaysia. They might also be able to identify the evidence of Fisher Effect in conventional and Islamic market. Lastly, in terms of data availability, this study uses time-series analysis from 2010 until 2017. The constraint is the number of observations is quite small since the Islamic market data is very limited. Future researchers

may use a panel data estimation approach by combining the data from Malaysia and other country. The result from panel data is more reliable as it includes the data from many countries within the specific time period.

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