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The importance of the Islamic banks in the monetary transmission mechanism in Malaysia

Zamrah Hasin[1], M. Shabri Abd. Majid[2]

[1]Kulliyyah of Economics and Management Sciences, International Islamic University Malaysia
[2]Faculty of Economics, Syiah Kuala University, Banda Aceh, Indonesia, E: hannanan@gmail.com, T: +6282160229553.

Abstract - Monetary policy influences the real economy through various channels, including bank lending. Currently, Malaysia is operating under dual banking systems: conventional and Islamic banking. The latter has the distinctive feature of interest-free. Hence, this study aims to empirically explore the relevance of Islamic banks' financing in channeling the monetary policy effects to the real economy. To achieve this objective, the study relies on an autoregressive distributed lag (ARDL) bound testing approach and innovation accounting approach and uses quarterly data spanning from 1991:Q1 to 2010:Q4. The study documents that Islamic financing channel for monetary transmission exists in Malaysia. Islamic financing is unequally distributed to economic sectors in response to monetary policy shock. Furthermore, the findings also reflect that Islamic banking, as operating a dual banking system, is not spared from the interest rate and monetary conditions of the country. This clearly shows the behavior of Islamic banking, which cannot shun the interest rate while its operation delinks from the interest rates. In designing monetary policy, the central bank should consider Islamic financing as an alternative or complement channel for monetary transmission, since this channel is just as active as conventional lending channel.

Keywords: Islamic banks, monetary transmission mechanism, autoregressive distributed lag, Malaysia

Introduction

The monetary policy conducted by central banks targets to influence the overall performance of the economy in order to achieve its objectives. The common objectives of monetary policy are: sustainable economic growth, stable price, full employment, and exchange rate stability. To achieve such objectives, central banks set an intermediate target, i.e. monetary aggregate or interest rate that are strongly linked to economic activities. For example, during a boom period, a central bank conducts tight monetary policy by raising interest rates or using other monetary policy tools, i.e., increase of statutory reserve requirement (SRR) or selling bonds, to reduce inflation. Following the increase of the interest rate, the price of loans increases which in turn encourages investors not to borrow. As a result, investment spending declines, thereby causing aggregate demand to decrease. Hence, output falls.

The channel of monetary transmission in affecting economic activities is also important and much relevant to the effectiveness of monetary policy. The above description has illustrated the mechanism of monetary transmission through the interest rate channel. The interest rate is used to influence the decision of investors in borrowing and making investments. Investment spending is part of GDP; lower investment spending will reduce aggregate demand, thereby causing the economic activities to decline. However, the interest rate channel is not the only channel that monetary policy can transmit through. There are also other channels that can be conduits for monetary transmission, such as bank lending, exchange rate, asset price and balance-sheet channels.

Bank lending is one of the conduits through which monetary policy can be transmitted. In a boom period with high inflation, a central bank might implement tight monetary policy by increasing the statutory reserve requirement (SRR) in order to reduce inflation. Upon this regulation, bank reserve decreases, causing fewer bank loans to be made available. Thus, investment spending declines, because of which fewer number of investors will be getting loans. Consequently, aggregate demand decreases, affecting output to decline. In this channel, banks play an important role as financial intermediaries that have

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specialized knowledge in making credit that costs them less than other sources. In market imperfection, there are some borrowers who depend on loans of banks. In other words, loans are perceived as imperfect substitutions for another type of credit, i.e., raising money in capital markets. Hence, the reduction of loans leads to the decline in investment spending, and consequently output decreases.

Bank lending channels have captured the attention of many economists and researchers. There is substantial literature in this area for developed countries, such as those by Bernanke and Blinder (1992), Gertler and Gilchrist (1993), Kashyap and Stein (1997), and Brissmis et al. (2001). Many studies document evidence supporting the existence of the bank-lending channel in many countries. Altunbas et al. (2002), for example, has found the bank-lending channel in Europe. Also, many aspects of the bank-lending channel have been analyzed, among them are: the issue of sensitivity of bank lending based on different size, capital strength and liquidity on monetary policy (Brissmis et al., 2001; Gambacorta, 2005; Worm, 2001), and also the issue of sectoral effects of monetary policy (Dale and Haldane, 1995; Dedola and Lippi, 2001; Arnold and Vrugt, 2002).

Furthermore, many studies on monetary transmission for developing countries were also conducted by those such as Arena et al. (2006), Agung (1998) and Ramlogan (2004). Various channels of monetary transmission are investigated in those countries. The results vary from one country to another, yet all of these studies seem to suggest the existence of credit channel (Ramlogan, 2004; Huang and Pfau, 2008; Ahmad, 2008). Some studies also document the factors affecting the activeness of the bank-lending channel, i.e., size, liquidity and origin of banks (Arena et al., 2006; Agung, 1998). However, these studies mainly focus on bank lending from conventional banking system only.

Unlike other countries, Malaysia is operating under the dual banking system, namely conventional and Islamic banking systems. This makes Malaysian banking system unique. Therefore, the bank-lending channel in Malaysia can be viewed in two aspects. The first aspect is the traditional lending channel through conventional banks, while the second one is the financing channel, through Islamic banks.

However, both conventional and Islamic banks provide similar products and services, but with different underlying contracts. Deposit and financing are based on loan contracts in conventional cases. In contrast, Islamic banks provide deposit and financing based on Islamic contracts such as *wadi'ah, mudarabah, musharakah and murabahah*. The reason such practices are exercised is that the interest is prohibited by Islam. Such practices help avoid the elements of interest. Thus, this unique feature of Islamic banking has brought a new avenue to the banking industry, and it affects all parties involved in the industry including depositors, investors, borrowers and also those in economic and social welfare organizations.

Like conventional banks, Islamic banks are under supervision and regulation of the central bank of Malaysia, Bank Negara Malaysia (BNM). Therefore, BNM has the power to control and influence the Islamic banks, as it has the control on conventional banks. For example, deposits from Islamic banks is subject to SRR and also liquidity requirement ratios (LRR). An increase (decrease) of SRR will affect bank reserve to (decrease) so that banks' financing will reduce (increase). Based on the theoretical background of the bank-lending channel, it is questionable whether monetary policy can be passed through the Islamic financing channel or not? If yes, how strong it is?

In this light, both bank lending and Islamic financing channels are investigated. In terms of bank-lending channels, existing studies show that monetary transmission through them is active; for example, Goh and Yong (2007), Kassim and Majid (2009), Kassim (2006) and Sayuti (2009). Few other studies, such as Domac (1999), Ibrahim (2005) and Karim et al. (2006) focus on the distributional effects of monetary policy in Malaysia. These studies seem to suggest the disparities in the effects of monetary policy on bank lending and economic sectors.

With regard to the Islamic financing channel, there are hardly any studies. This may be due to the recentness of the establishment and improvement of Islamic banking systems in Malaysia. The limited existing studies, however, investigate mainly to prove the existence of Islamic financing channels for monetary transmission in Malaysia (Said and Ismail, 2007; Sukmana and Kassim, 2010; Sayuti, 2009). Other than documenting the presence of Islamic financing channels for monetary transmission in Malaysia, they do not employ methodologies such as the VAR model, or structural VAR model, in producing empirical results (Sayuti, 2009; Said and Ismail, 2007; Kassim, Majid and Yusof, 2009). Then, there are few studies that analyze the causality between interest rate and Islamic financing by using the Toda-Yamamoto approach. The results show strong causality between the interest rate and Islamic financing (Ibrahim and Sukmana, 2011). Nevertheless, no study explored the distributional effects of monetary policy on Islamic financing. This aspect still thus demands further investigating.

To this end, the present study may fills up the space left by reexamining the current Islamic financing channels relying on different methods—the ARDL model, for instance. The study also would take the challenge of exploring distributional effects of monetary policy on Islamic financing as well as economic sectors. The study expects to produce findings that would enrich the literature along these lines.

Specifically, this study aims at investigating whether or not there exists any Islamic financing channel in Malaysia; analyzing the distributional effects of monetary policy on the Islamic financing provided for various economic sectors such as agriculture, manufacturing and construction, and assessing the sensitivity of various economic sectors to monetary policy stance and Islamic financing change.

The remainders of the study are organized in the following manner: Section 2 provides the review of literature on the bank-lending channel. Section 3 is devoted to discuss methodology employed in this study, while Section 4 discusses the empirical results and findings of the study. Finally, Section 5 concludes and summarizes the major findings of the study.

2. Monetary transmission mechanism

Monetary transmission mechanism is one of the economic topics of research that has been explored by many researchers. This may be because of the importance and the dynamic of the matter itself. Understanding the monetary transmission mechanism would give the central bank the most effective channel in conducting monetary policy and in affecting economic activities. This is perhaps the challenging task for many central banks since there are many channels that could be conduits for monetary transmission.

Channels of monetary transmission mechanism

The objectives of monetary policy are to achieve its targets such as sustainable economic growth and instituting stable price. It is important for policy makers to understand monetary transmission mechanisms in order to influence economic variables. The channels of monetary transmission have been well established at least in theory. For the purpose of this research, four channels of monetary transmission will be discussed.

Interest rate channel

A monetary transmission mechanism with interest rate channel has been established for over fifty years. The mechanism is based on the basic Keynesian IS/LM model in mainstream economics (Mishkin, 1996). This channel is also known as money view. In money view, monetary policy stance can influence economic variables via interest rate. The mechanism of this monetary transmission can be illustrated as below, assuming that it is monetary contraction:

$$M\downarrow \Rightarrow i\uparrow, I\downarrow \Rightarrow Y\downarrow$$

When monetary contraction is implemented, it affects real interest rate, causing it to increase. High real interest rate would increase the cost of borrowing to investors. Therefore, the investment spending falls, which cause the decrease of aggregate demand thereby causing economic output to decrease.

Bank lending channel

Monetary policy can be transmitted through the bank-lending channel. In this channel, banks as financial intermediaries play a crucial role. To understand this channel, two assumptions must hold. Firstly, monetary policy must have the ability in influencing bank loans. Secondly, there is no perfect substitutability between retail bank deposits and other sources of funding for banks. The following schematic will show the mechanism.

$$M\downarrow \Rightarrow \text{deposit}\downarrow \Rightarrow \text{bank loan}\downarrow \Rightarrow I\downarrow \Rightarrow Y\downarrow$$

When the central bank conducts monetary contraction, bank loans decrease in response to the fall in the bank reserve. Therefore, supply of bank loans to investors decreases, leading to decline in investment spending. As a consequence, output will decrease.

Asset price channel

Under the asset price channel, there are two conduits that monetary policy has to pass-through: Tobin's q theory of investment and wealth effects. However, these two channels are almost the same except that the Tobin's q channel will affect investment decisions, while wealth effect channel will involve the consumption decision.

Tobin's q theory can be the channel for monetary transmission affecting economic variables through the valuation of equities. Tobin defines q as "the market value of firms divided by the replacement cost of capital" (Mishkin, 1996). If the value of q is high then the company will invest more because the value of the firm is higher than the replacement cost of capital and otherwise. The schematic of this channel can be presented as below.

$$M\downarrow \Rightarrow P_e\downarrow \Rightarrow_q \downarrow \Rightarrow I \downarrow \Rightarrow Y\downarrow$$

From the above schematic, money supply decreases in the economy because of monetary contraction. Individuals would have less money than they want. Therefore, in order to smooth their consumption they will try to sell their assets—securities for instance. This will decrease the demand for stock thereby leading the price of stock to decrease. Hence, the q value of firms falls. Firms will reduce their investments, which will cause output to fall.

Under wealth effect, monetary transmission goes through wealth effect on consumption. Based on the life-cycle hypothesis model, consumption spending is determined by lifetime resources. If the value of wealth increases permanently, this would also increase the consumption of individuals. The following schematic presents the mechanism.

$$M\downarrow \Rightarrow P_e\downarrow \Rightarrow W\downarrow \Rightarrow \mathbf{C}\downarrow \Rightarrow Y\downarrow$$

Monetary contraction affects the value of stock prices, causing them to decline. Since most of the financial asset is common stock, the decrease of stock price leads to decrease of wealth. Therefore, the individual will decrease their consumption. As a result, because of the decrease in aggregate demand output will fall.

Exchange rate channel

With an open economy, the country has to involve international transactions. To accommodate international trade, the exchange rate has to be preset. Under flexible exchange rate systems, the impact of change in interest rate can be absorbed by the exchange rate (Mishkin, 1995). Therefore, monetary transmission can also pass-through the exchange rate which affects economic variables such as inflation and output. The schematic of the exchange rate channel is presented below.

$$M\downarrow \Rightarrow i, \uparrow I\downarrow Y \Rightarrow \downarrow$$

From the schematic above, when monetary policy contraction is implemented, the real interest rate increases, which makes the domestic real interest rate relatively higher than the foreign real interest rate. Consequently, the funding from foreign investors will flow into the country, and the exchange rate will appreciate causing the price of exported products to be relatively higher than other foreign competitors. Therefore, as a result of decrease in aggregate demand, output will decline.

There have been many studies on the monetary transmission through the bank-lending channels. Most of the studies support the presence of the bank-lending channel. Nevertheless, the effectiveness of this channel is still conclusive.

Among the early empirical studies on the bank-lending channel is Bernanke and Blinder (1992). They investigate the sensitivity of supply of reserve of the banks in the US on the federal fund rate shock as a monetary policy by employing the VAR model from 1959 to 1978. The finding shows that monetary policy contraction works in part by affecting the composition of bank assets. During tight monetary policy, banks will sell securities to smooth their loan supply. Nevertheless, over time banks will arrange a new loan and terminate the old loan in response to such monetary policy.

Cetorelli and Goldberg (2008) examined monetary policy through the bank-lending channels of two different categories of banks, namely domestically-oriented banks which do not have international operation, and global-oriented banks. Their study showed that monetary policy only passes through domestically-oriented banks while global-oriented banks rely on internal capital markets in smoothing their liquidity. Therefore, they concluded that the bank-lending channel in the US would be diminishing in strength if banking becomes more globalized.

Agung (1998) used bank level data from Indonesia spanning from 1983 to 1995 to investigate the responses of different bank classes to monetary policy changes by employing VAR model. The study concluded that monetary contraction does not influence the lending of state banks, but does so to the lending of small banks. Besides, credit for investment and working capital from small banks decline more than state banks during tight monetary policy. However, consumer loans fall for all bank types.

Yusof (2006) examined the monetary policy channels in affecting aggregate and sectoral output in Asian countries, namely Malaysia, Indonesia, the Philippines, Singapore and Thailand. The study employed the cointegration and VECM approach. The most effective variable in effecting output is M1 for Malaysia and the Philippines, M2 for Indonesia and Thailand, and bank-lending for Singapore. Nevertheless, only the impact of monetary policy on sectoral output of Malaysia is significant. The results indicated that agriculture and manufacturing services, and construction sectors are affected most by M1, M2 and credit lending, respectively.

Said and Ismail (2005), investigated the bank-lending channel in Malaysia and also attempted to examine the size and capital strength of banks for the effectiveness of the channel. They used bank level data and applied fixed effect cross-sectional models with GLS estimation. The results supported the presence of the bank-lending channel, but they seemed to suggest that size and capital strength are irrelevant on the performance of the channel. Ghazali (2005) conducted a similar study but with different methods. The study used aggregate data of loans over the period from 1982 to 1999 and employed the Granger causality approach. The findings showed that there is strong causation running from bank liabilities to bank assets, while the result also indicated significant causation, running from the credit variables to the performance of the economy.

Sayuti (2009) employed the structural VAR model under small open economy framework. The study documented the presence of the bank-lending channels in Malaysia. In the same vein, Goh and Yong (2007) used bank level data and employed Autoregressive distributed lag (ARDL) model in finding the evidence for the existence of bank-lending transmission in Malaysia before and after the structural shift in interest rate. The results are different in these two periods. Before the shift, tight monetary policy influenced loan supply, which in turn supported the bank-lending view. However, it had a limited strength after the shift, which indicated to the reduced effectiveness of the channel.

A similar study by Kassim (2006) applied multivariate causality analysis based on VECM and Toda-Yamamoto method, and Variance decomposition. The overall results showed the presence of bank-lending channels in Malaysia. Besides, the study also showed that smaller banking institutions are more sensitive to monetary change than larger banking institutions.

In addition, Karim et al. (2006) analyzed the impacts of monetary policy on commercial banks in Malaysia, lending to various economic sectors by using VAR model. The results showed that the tight monetary policy has a negative impact on bank lending to economic sectors. Meanwhile, bank lending to economic sectors also responds differently to monetary policy shocks. A similar study by Ibrahim (2005) also confirmed potential disparities in the effect of monetary policy on real sectoral activities in Malaysia.

Said and Ismail (2007) analyzed the role of Islamic banks in the transmission of monetary policy in Malaysia. He employed fixed effect model with GLS estimation and used 15 commercial Islamic bank balance sheets. The study showed the presence of financing channels in Malaysia. On the other hand, Sayuti (2009) employed the structural VAR model in investigation of monetary policy transmission through the Islamic financing channel in Malaysia. The study confirmed the results of earlier studies.

Sukmana and Kassim (2010) analyzed the effects of Islamic financing and deposits in monetary transmission on real economy. They found that Islamic financing and deposits can be the conduits in liking the monetary policy indicator to economic activities. In addition, Ibrahim and Sukmana (2011) evaluated the dynamic interactions between Islamic financing and macroeconomic and financial variables using Toda-Yamamoto causality test and innovation accounting approach. The results suggested strong causal influences of interest rate, but not of real stock price and real production, on Islamic financing.

Kassim, Majid and Yusof (2009) investigated the impact of monetary policy shocks on conventional and Islamic banks in Malaysia. The study employed VAR model with monthly aggregate data. The finding showed that the impact of monetary policy change is more sensitive for Islamic banks than the conventional banks.

To summarize, the existing studies seem to agree that the Islamic financing channel is active in Malaysia. However, there are other issues which are yet to be investigated such as distributional effects of monetary policy on Islamic financing to various economic sectors and the effectiveness of the channel in respect to size, capital strength and liquidity of Islamic banks. To fill up the space left, the present study takes up the challenge of exploring the issue of distributional effects of monetary policy on Islamic financing as well as economic sectors. The study would also reinvestigate to prove the presence of Islamic financing channels in Malaysia.

3. Empirical framework

Data

This research attempts to examine whether Islamic financing can be the channel for monetary transmission or not and also to analyze the distributional effects of monetary policy in the context of Malaysia. The study utilizes quarterly data from 1999.Q1 to 2010.Q4. The study uses five main variables, namely interest rate, total Islamic financing and eight sectoral Islamic financing, economic growth (proxied by real Gross Domestic Product (GDP) and eight sectoral GDP, inflation rate and real effective exchange rate. Table 1 describes the data and their sources.

Methodology

To accomplish the objectives of the study, various techniques and methods were employed. The study cautiously chooses the methods and approaches that are most suitable to the purposes and objectives of the study as well as to the data.

To simplify the analysis, the analysis is divided into three systems, namely aggregate system, financing system and output system. This is purposely made in order to answer each of the objectives of the study. The aggregate system refers to a five-variable system consisting of interest rate, real exchange rate, Islamic financing, inflation rate and GDP. This system is designed to examine the existence of the transmission of monetary policy through the Islamic financing channel. Meanwhile, the financing and output systems are designed to analyze the distributional effects of monetary policy on Islamic financing and economic sectors. Each system consists of eight sub systems. The financing system refers to a six-variable system consisting of interest rate, real exchange rate, total Islamic financing less financing to the sector under consideration (i.e., total financing less financing given to agriculture sector

Table 1. Data description.

Variable	Description	Abbr.	Source
Monetary Policy	Interbank overnight money rate	*Int*	IMF
Financing	Total Islamic financing	*Fnc*	BNM
	Islamic financing for primary agriculture sector	*Fag*	BNM
	Islamic financing for mining and quarrying sector	*Fmi*	BNM
	Islamic financing for manufacturing sector	*Fma*	BNM
	Islamic financing for electricity, gas and water sector	*Fel*	BNM
	Islamic financing for wholesale and retail trade, hotels and restaurants sector	*Fwh*	BNM
	Islamic financing for construction sector	*Fco*	BNM
	Islamic financing for transport, storage and communication sector	*Ftr*	BNM
	Islamic financing to finance, insurance and business services sector	*Ffi*	BNM
Output	Aggregate gross domestic product	*Gdp*	BNM
	Output in agriculture, forestry and fishing sector	*Gag*	BNM
	Output in mining and quarrying sector	*Gmi*	BNM
	Output in manufacturing sector	*Gma*	BNM
	Output in electricity, gas and water sector	*Gel*	BNM
	Output in wholesale and retail trade, accommodation and restaurants sector	*Gwh*	BNM
	Output in construction sector	*Gco*	BNM
	Output in transport, storage and communication sector	*Gtr*	BNM
	Output in finance, insurance, real estate, and business services sector	*Gfi*	BNM
Inflation Rate	Consumer price Index, 2005 base year	*Inf*	IMF
Exchange Rate	Real effective exchange rate	*Rex*	IMF

Note: The BNM data are from the *Monthly Statistical Bulletin* (various issues) while the IMF data are from *International Financial Statistics* CD-ROM. BNM = Bank Negara Malaysia; IMF = International Monetary Fund; Abbr = Abbreviation.

(*sfga*)), financing to the sector under consideration (i.e., financing providing to agriculture sector (*fga*)), inflation rate and GDP. Similarly, the output system refers to a six-variable system consisting of interest rate, real exchange rate, total Islamic financing, inflation rate, GDP less the sector under consideration and the output for the sector under consideration. The inclusion of aggregate financing and output (by less the amount of interested sector) into disaggregate systems is meant to increase the likelihood shocks in the monetary policy similarly across sectors (Ibrahim, 2005).

As a requirement for the time series analysis, it is necessary to examine the property of time series, i.e., the stationary properties. This is very critical to avoiding spurious regression. In this study, we employ augmented Dickey-Fuller (ADF) unit root test, which was developed by Dickey and Fuller (1979). The test may be estimated in three different forms to allow various possibilities. The regressions are as follows:

1. The regression with intercept
$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + \sum_{i=1}^{m} \propto_1 \Delta Y_{t-1} + \varepsilon_t \quad (1)$$
2. The regression with intercept and trend
$$\Delta Y_t = \beta_1 + \beta_2 T + \delta Y_{t-1} + \sum_{i=1}^{m} \propto_1 \Delta Y_{t-1} + \varepsilon_t \quad (2)$$
3. The regression without intercept
$$\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^{m} \propto_1 \Delta Y_{t-1} + \varepsilon_t \quad (3)$$

where T is trend, Δ is difference operator and ε is pure white noise error term.

This requires us to test the significance of δ whether the time series is stationary or otherwise. In each form, the hypotheses are as below.

Null hypothesis: H_0: δ = 0 (i.e. the time series is non-stationary)
Alternative hypothesis: H_0: δ < 0 (i.e. the time series is stationary)

The next step of analysis is to conduct a cointegration test. The test examines the existence of long-run equilibrium relationships among variables. In this regard, the autoregressive distribution lag (ARDL) framework for cointegration which is introduced by Pesaran, et al. (2001) is adopted. There are numerous advantages of the ARDL approach. Firstly, it employs only one single reduced form equation. Secondly, it does not require pre-testing variables. This means that the cointegration test is applicable to underlying regressors regardless of its integration, whether purely I(0) or purely I(1) or mixture of both. Thirdly, the ARDL is also applicable for small number of observations. Fourthly, it avoids the larger number of specification made in the conventional cointegration (Duasa, 2007). Lastly, it takes sufficient of lags to capture the data generating process whereby it estimates $(p+1)^k$ number of regressions to obtain optimal lag-length for each variable, where p is the maximum lag and k is the number of variables in the equation (Karim and Majid, 2010). Having a small number of observations of 48 as well as considering the advantages of ARDL, it justified that the study employ the ARDL approach for cointegration test.

The ARDL involves estimating the conditional error correction version of the ARDL model relating to dependent variables and its determinants. The process of cointegration test is applied to all three systems in our analysis. To conserve space, only the ARDL model for aggregate system is shown below:

$$\begin{aligned}\Delta \text{fnc} = {} & \alpha_0 + \sum_{i=1}^{p} \lambda_{1i} \Delta fnc_{t-1} + \sum_{i=1}^{p} \lambda_{2i} \Delta int_{t-1} \\ & + \sum_{i=1}^{p} \lambda_{3i} \Delta rex_{t-1} + \sum_{i=1}^{p} \lambda_{4i} \Delta inf_{t-1} \\ & + \sum_{i=1}^{p} \lambda_{5i} \Delta gdp_{t-1} + \varnothing_1 \text{fnc}_{t-1} + \varnothing_2 \text{int}_{t-1} \\ & + \varnothing_3 \text{rex}_{t-1} + \varnothing_4 \text{inf}_{t-1} + \varnothing_5 \text{gdp}_{t-1} + \varepsilon_t \end{aligned} \quad (4)$$

where Δ is the difference operator, *fnc* is total Islamic financing, *int* is overnight interest rate, *rex* is real exchange rate, *inf* is inflation rate, *gdp* is aggregate output, ε_t is white noise error term and *p* is the optimal lag length.

In order to test cointegration, the null hypothesis H_0: $\varnothing_1 = \varnothing_2 = \varnothing_3 = \varnothing_4 = \varnothing_5 = 0$ (i.e. there is no cointegration among variables) is tested against the alternative hypothesis H_1: $\varnothing_1 \neq \varnothing_2 \neq \varnothing_3 \neq \varnothing_4 \neq \varnothing_5 \neq 0$ (i.e. there is cointegration among variable or there exists the long-run relationship among variables.). The F-test has a non-standard distribution. Therefore, the critical value bounds are generated. The critical value bound consists of the critical values for I(0) and I(1) series which are referred as lower bond and upper bound respectively. If the calculated F-statistics exceed their respective upper critical values, we conclude that there is evidence of long-run relationship and that the null hypothesis cannot be accepted, and vice versa. Narayan (2005)'s critical value bounds are used as the study has a small sample size.

Following the cointegration test, the study extent its aggregate system analysis to long-run and short-run dynamic. Accordingly, the following long-run model is estimated.

$$\begin{aligned}\text{fnc}_t = {} & \alpha_1 + \sum_{i=1}^{p} \beta_{1i} fnc_{t-1} + \sum_{i=1}^{p} \gamma_{1i} int_{t-1} + \sum_{i=1}^{p} \delta_{1i} rex_{t-1} \\ & + \sum_{i=1}^{p} \theta_{1i} inf_{t-1} + \sum_{i=1}^{p} \sigma_{1i} gdp_{t-1} + \mu_t \end{aligned} \quad (5)$$

In addition, the short-run dynamics based on ARDL specification is derived by constructing an error correction model as below:

$$\begin{aligned}\Delta \text{fnc}_t = {} & \alpha_2 + \sum_{i=1}^{p} \beta_{2i} \Delta fnc_{t-1} + \sum_{i=1}^{p} \gamma_{2i} \Delta int_{t-1} + \sum_{i=1}^{p} \delta_{2i} \Delta rex_{t-1} \\ & + \sum_{i=1}^{p} \theta_{2i} \Delta cpi_{t-1} + \sum_{i=1}^{p} \sigma_{2i} \Delta gdp_{t-1} + \psi_t \text{ECM}_{t-1} + \zeta_t \end{aligned} \quad (6)$$

where ECM_{t-1} is the error correction term.

To further investigate the presence of the Islamic financing channel, the study explores further by conducting multivariate causality tests. This test enables to see the direction of causality between variables, i.e. causality relationship between monetary policy and Islamic financing. To this end, the vector error-correction model (VECM) for aggregate system is formed as below;

$$\begin{bmatrix}\Delta fnc_t\\ \Delta int_t\\ \Delta rex_t\\ \Delta inf_t\\ \Delta gdp_t\end{bmatrix}=\begin{bmatrix}k_1\\ k_2\\ k_3\\ k_4\\ k_5\end{bmatrix}+\sum_{i=1}^{p}\begin{bmatrix}n_{11i} & n_{12i} & n_{13i} & n_{14i} & n_{15i}\\ n_{21i} & n_{22i} & n_{23i} & n_{24i} & n_{25i}\\ n_{31i} & n_{32i} & n_{33i} & n_{34i} & n_{35i}\\ n_{41i} & n_{42i} & n_{43i} & n_{44i} & n_{45i}\\ n_{51i} & n_{52i} & n_{53i} & n_{54i} & n_{55i}\end{bmatrix}\begin{bmatrix}\Delta fnc_{t-1}\\ \Delta int_{t-1}\\ \Delta rex_{t-1}\\ \Delta inf_{t-1}\\ \Delta gdp_{t-1}\end{bmatrix}+\begin{bmatrix}\lambda_1\\ \lambda_2\\ \lambda_3\\ \lambda_4\\ \lambda_5\end{bmatrix}[ECM_{t-1}]+\begin{bmatrix}\varpi_{1t}\\ \varpi_{2t}\\ \varpi_{3t}\\ \varpi_{4t}\\ \varpi_{5t}\end{bmatrix} \quad (7)$$

where k is constant term, n is coefficient of lagged independent variables, λ is error- correction coefficient and ϖ is error term.

4. Empirical results

The results will be reported step by step as the study progresses. It starts with unit root test's results and is followed by cointegration's results. For extension of aggregate system analysis, a long-run model and short-run dynamic derived from the ARDL model as well as multivariate causality analysis are included.

Unit root tests

Table 2 summarizes the results of the ADF unit root test for the data series. The results may be classified into five cases. Firstly, almost all the data series are not significant at level, but they are significant at first difference. Secondly, some data series are significant with intercept, at level and also significant at least at 5% level at first difference. They are *fma*, *fel*, *gmi*, *sfag*, *sfma*, *sfco*, and *sftr*. Thirdly, there are four data series namely *fco*, *gag*, *gfi* and *sgmi* under this case. The variables are only significant with trend and intercept at log level with 1% significance level except for *fco* at 5% significance level.

Fourthly, for *fag*, *fmi* and *sffi*, their null hypotheses are rejected at log level with intercept, and trend and intercept at 1% significance level. For *sfwh*, it is also under this group but slightly different in term of significance level. The series is significant at 5% level with intercept and at 10% level with intercept and trend. At first difference, the series are also significant at least at 10% level. Lastly, two data series are found to be non-stationary, both in level and in first difference, i.e., *gco* and *gwh*. Therefore, the study decided to drop these variables in the analysis because they do not suggest any stationarity at first difference despite of being dependent variable in the ARDL model.

Cointegration tests

To examine the existence of the long-run relationship among variables, the study adopts a bound testing approach and Autoregressive distributed lag (ARDL) model for cointegration testing. This framework was originally proposed by Pesaran, et al. (2001). The advantages of the ARDL model are that it is applicable for underlying regressors, which are purely I(0), or I(1), or a mixture of both. It is also able to deal with even small sample numbers (Duasa, 2007). In the present case, the variables are a mixture of I(0) and I(1) with an observation number of only 48. Therefore, it is justified to apply the ARDL model for cointegration testing in the study.

To be consistent with our objectives, we report the results into three tables, namely Tables 2, 3 and 4., each representing the aggregate, financing, and output system respectively. The aggregate system refers to a five-variable system consisting of total Islamic financing, overnight interest rate, real exchange rate, inflation rate and GDP.

The financing system is a six-variable system consisting of Islamic financing to sector under consideration, overnight interest rate, real exchange rate, inflation rate, economic growth and total Islamic financing less the financing of sector under consideration. Due to the deletion of *fag* and *fmi* in the previous section, the total financing sub-systems are left to be only six, namely *fmas*, *fels*, *fwhs*, *fcos*, *ftrs* and *ffis*.

Like the financing system, the output system is a six-variable system consisting of output sectors under consideration, overnight interest rate, real exchange rate, inflation rate, and GDP less the output of sector under consideration. There are only six sub systems for output, namely *gags*, *gmis*, *gmas*, *gels*, *gtrs* and *gfis* since *gco* and *gwh* are dropped from the analysis in the previous section.

In each table the computed F-statistics for each lag length are presented. The last column of each table also includes the critical value bounds for unrestricted intercept and no trend, which were obtained from Narayan (2005), for sample sizes between 30 and 80. If the F-statistics exceed their respective upper critical values at any lag-length, it implies that there exists the long-run relationship among variables and vice versa.

Table 3 shows calculated F-statistics from lag length 1–6 for the aggregate system. At lag length, 1–5 are found to be significant at least at 5% level. This implies that the null hypothesis of no cointegration cannot be accepted at a 5% level. Therefore, there is a cointegration relationship among the variable in aggregate system, implying that the variables tend to move together in the long run.

Table 4 presents the ARDL cointergration's results for a financing system. The calculated F-statistics of all financing sub-systems, except *fcos*, are found to be higher than their upper bound critical value, at least at 10% level of significance with at least one lag length, if not all. The null hypothesis of no cointegration can be rejected at a 10% level. This implies that *fmas*, *fels*, *fwhs*, *ftrs* and *ffis*, have long-run relationships among the variables in the system. Regarding to *fcos*, it is found that there exists no cointegration. Hence, and since it is not consistent with the other systems, it was dropped from the analysis.

Table 5 shows the result of ARDL cointegration tests for output systems. Only *gags* is not significant at all levels and at all lag lengths. The remaining, namely *gmis*, *gmas*, *gels*, *gtrs* and *gfis,* are found to be significant at least at 10% level with at least one lag length, if not all. Their null hypothesis of no cointegration is rejected at 10% level of

Table 2. Unit root tests summary statistics

	Augmented Dickey-Fuller					
	Level			1st difference		
Variable	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	None
Int	–2.321	–2.254	0.038	–10.109***	–9.626***	–10.382***
Fnc	–2.501	–2.228	2.696	–3.863***	–4.303***	–2.476**
Fag	–4.863***	–4.466***	1.703	–7.966***	–8.505***	–7.517***
Fmi	–5.212***	–6.231***	0.627	18.402***	18.357***	18.230***
Fma	–5.144***	–2.985	2.992	–4.542***	–5.687***	–3.336***
Fel	–2.619*	–2.595	0.876	–6.866***	–5.575***	–6.776***
Fwh	–1.240	–1.551	2.890	–7.599***	–7.574***	–3.521***
Fco	–2.663	–3.738**	3.309	–6.578***	–6.543***	–5.593***
Ftr	0.083	–1.586	2.232	–6.299***	–6.450***	–5.928***
Ffi	–1.033	–2.855	3.107	–7.687***	–7.622***	–6.361***
Gdp	–0.793	–2.079	2.787	–4.363***	–4.319***	–3.065***
Gag	–0.273	–3.961**	1.424	–6.789***	–6.804***	–8.625***
Gmi	–2.699*	–2.550	1.840	–4.986***	–5.115***	–4.778***
Gma	–0.740	–2.222	1.438	–7.614***	–7.555***	–3.816***
Gel	–1.155	–2.568	4.037	–10.374***	–10.331***	–2.103**
Gwh	–0.161	–2.358	2.154	–2.538	–2.516	–1.310
Gco	0.409	–0.826	1.471	–1.827	–2.401	–1.212
Gtr	–1.345	–2.564	2.491	–3.579**	–3.533**	–2.330**
Gfi	–1.588	–4.895***	3.182	–9.695***	–9.719***	–8.325***
Inf	0.468	–2.489	4.657	–5.415***	–5.416***	–4.069***
Rex	–2.226	–1.536	0.350	–5.069***	–5.000***	–5.110***
Sfag	–4.513***	–2.892	2.681	–3.717***	–4.268***	–2.223**
Sfmi	–2.538	–2.239	2.657	–3.824***	–4.284***	–2.473**
Sfma	–3.921***	–2.022	2.763	–10.215***	–11.321***	–2.600**
Sfel	–2.593	–2.171	2.561	–3.642***	–4.157**	–2.332**
Sfwh	–4.375***	–3.406*	6.122	–11.205***	–12.635***	–1.621*
Sfco	–2.673*	–2.361	2.609	–3.762***	–4.308***	–2.418**
Sftr	–2.628*	–2.423	2.700	–3.904***	–4.284***	–1.594
Sffi	–5.075***	–5.476***	2.618	–3.772***	–4.248***	–1.553
Sgag	–0.932	–1.991	2.617	–4.151***	–4.126**	–2.976***
Sgmi	–0.506	–4.524***	3.042	–4.226***	–4.154**	–2.635***
Sgma	–0.709	–2.555	2.746	–4.034***	–3.986**	–2.701***
Sgel	–0.789	–2.084	2.756	–4.349***	–4.304***	–3.079***
Sgwh	–1.230	–2.766	2.823	–6.756***	–6.732***	–3.328***
Sgco	–0.850	–2.012	2.722	–4.301***	–4.265***	–3.052***
Sgtr	–0.760	–2.064	2.766	–4.413***	–4.366***	–3.146***
Sgfi	–0.688	–1.824	2.859	–4.775***	–4.705***	–3.482***

Note: *,**,*** denote significance at 10%, 5% and 1% level respectively. Critical values are based on MacKinnon (1996). Lag lengths are based on Schwarz Info Criterion (SIC) with maximum lag of 10.

significance. This provides evidence that each output subsystem, except *gags*, is cointegrated implying that the long-run relationship among the variables in the system exists. Like *fcos*, the study had to drop *gags* from the analysis since the system is not cointegrated, that is because it will not consistent with the present analysis.

Cointegrating regression results (Long-run model)
In order to serve the objective of the study, the aggregate system analysis was extended and the long-run relationship of aggregate systems was investigated. If the variables have long-run relationships, then the long-run model can be constructed. In the previous section, the study found evidence of cointegration in the aggregate system. This implies that there is a long-run relationship among the variables in the aggregate system. Hence, the long-run model can be established. Table 6 presents the long-run model using the ARDL approach. By estimating it, the study follows Majid and Yusof (2007), Majid (2007) and Karim and Majid (2010) in identifying the maximum lag order. The lag order of 1 is chosen as it reveals the highest F-statistics value (see Table 3). The ARDL (1,0,0,0,0) is selected based on Schwarz Bayesian Criterion (SBC).

In the long-run model, it seems that overnight interest rate has a negative relationship with Islamic financing. If the interest rate increases by one percent, the Islamic financing will decrease by 0.04 percent. This suggests that interest rate as a proxy of monetary policy can affect Islamic financing and it proves the existence of the active of bank-lending/financing channel for monetary transmission. This result is also consistent with many studies (Said and Ismail, 2007; Sayuti 2009; Sukmana and Kassim, 2010).

The model also indicates a positive relationship between the real exchange rate and Islamic financing. A one percent increase in real exchange rate will increase Islamic financing by 0.28 percent. The explanation for this could be indirect. When the currency depreciates (i.e., real exchange rate index increases), the domestic good becomes cheaper

Table 3. ARDL cointegration test for aggregate system.

Lag	F-statistics	Bound critical values (unrestricted intercept and no trend)
1	9.121***	
2	4.845**	
3	5.209**	k = 4 & n = 48
4	4.748**	1% ; 4.306–5.874
5	4.841**	5% ; 3.136–4.416
6	3.653	10% ; 2.614–3.746

Notes: *,**,*** denote significance at 10%, 5% and 1% level respectively.
The critical value bounds are obtained from Narayan (2005).

Table 4. ARDL cointegration test for financing system.

Lag length	F-statistics						Bound critical values (unrestricted intercept and no trend)
	fmas	*Fels*	*fcos*	*fwhs*	*ftrs*	*ffis*	
1	4.082*	3.456	2.035	3.473	1.919	4.267**	
2	2.375	4.272**	2.501	3.025	1.725	3.950**	K = 5 & n = 48
3	4.320**	2.180	1.871	3.526	1.217	3.635*	1% ; 3.955–5.583
4	5.985***	8.087***	1.164	4.769**	3.070	3.652*	5% ; 2.900–4.218
5	2.529	2.326	1.923	1.263	8.769***	6.580***	10% ; 2.435–3.600

Notes: *,**,*** denote significance at 10%, 5% and 1% level respectively.
The critical value bounds are obtained from Narayan (2005).

Table 5. ARDL cointegration test for output system.

Lag Length	F-statistic						Bound critical values (unrestricted intercept and no trend)
	gags	*gmis*	*gmas*	*gels*	*gtrs*	*gfis*	
1	1.159	3.606*	2.725	3.624*	2.501	2.321	
2	0.781	2.443	0.775	1.216	1.959	8.319***	K = 5 & n = 48
3	0.501	1.858	1.633	1.734	2.176	2.155	1% ; 3.955–5.583
4	0.753	4.245**	2.104	3.311	7.245***	2.520	5% ; 2.900–4.218
5	0.656	1.419	6.893***	3.146	9.679***	1.708	10% ; 2.435–3.600

Notes: *,**,*** denote significance at 10%, 5% and 1% level respectively.
The critical value bounds are obtained from Narayan (2005).

Table 6. Long-run model.

Dependent variable	Independent variables			
	int_{t-1}	rex_{t-1}	inf_{t-1}	gdp_{t-1}
Fnc	–0.041***	0.284**	–0.294	0.254***
	(0.009)	(0.105)	(0.194)	(0.086)

Notes: *,**,*** denote significance at 10%, 5% and 1% level respectively.
Standard error is in parentheses.

Table 7. Error correction model.

Independent variables	Coefficient	Standard Error
Δint	–0.058**	0.024
Δrex	0.236	0.201
Δinf	–1.333**	0.502
Δgdp	0.242**	0.088
Δc	–2.432***	0.753
Ecm_{t-1}	–0.077***	0.024
Diagnostic tests		
R^2	0.919	
Adj-R^2	0.895	
DW	2.175	
χ^2 LM	7.068	
χ^2 RESET	3.702*	
χ^2 Norm	6.022**	
χ^2 Hetro	9.172***	

Notes: *,**,*** denote significance at 10%, 5% and 1% level respectively. LM is Lagrange multiplier test of residual serial correlation. RESET is Ramsey's RESET test of functional form. Norm is Jarque-Bera test of normality. Hetro is White test for heteroscedasticity. DW is Durbin-Watson statistics.

than foreign goods, thereby causing net export to increase, and hence in aggregate demand (Mishkin, 1996). This, in turn, raises the demand for money thereby increasing Islamic financing. For the GDP, it also shows a positive relationship with Islamic financing. When GDP rises by one percent, Islamic financing will increase by 0.25 percent. When aggregate output increases, it raises the demand for credit thereby causing the financing to increase. This may infer that Islamic financing cannot turn away from the fluctuation in the real economic activities (Ibrahim, 2005).

In conclusion, the findings seem to suggest that overnight interest rate, real exchange rate and GDP are linked to Islamic financing over the long run. We could see at least in the long run, the direction of relationship of the variables with Islamic financing where interest rate is shown to have positive relationship while real exchange rate and GDP are evidently opposite.

Error correction model (ECM)
This section turns to short-run dynamics of Islamic financing. The error correction model (ECM) is established based on the ARDL model by retaining the lag length of 1 as suggested in the previous section. The ECM of the ARDL (1,0,0,0,0) based on SBC is reported in Table 6.

Except real exchange rate, the coefficients of variables are significant at least at the 5% level. The sign coefficients of these variables are the same as the long-run model. The Islamic financing still evidently has a negative relationship associated with interest rate, whereby it positively links with GDP. Here coefficient of inflation rate appears to be significant while it failed in the long-run model. The inflation rate seems to have a negative relationship with Islamic financing. The findings seem to suggest that monetary policy, i.e., overnight interest rates, together with GDP, are linked to the change of Islamic financing at least in the short-run. The explanation for the first could be that, contraction monetary policy may reduce the availability of Islamic financing by means of raising statutory reserve requirements. On the other hand, during recession when aggregate demand decreases, it results in a decrease of demand for financing.

The coefficient of the ECM is negative and highly significant at 1%. This confirms the existence of stable long-run relationships among the variables. The coefficient of ECM is –0.077 indicating slow rate of convergence to equilibrium. It implies that a deviation from the long-run equilibrium following the short-run shock is corrected by 7 percent after one quarter. Table 7 also provides the diagnostic test. The underlying ARDL equation fits very well at adjusted $R^2 = 0.895$ while DW is more than 2. We find no evidence of serial correlation, but fail for functional form, normality and heteroscedasticity tests.

Multivariate causality test

To produce more evidence for aggregate system, multivariate causality analysis is conducted. The VECM approach makes us differentiate between short- and long-run forms of Granger causality. Here, the F-statistics of lagged difference independent variables indicate the short-run causal effects while the t-statistic of the lagged error correction terms shows the long-run causal effects (Yusof, 2003).

Table 8 reports multivariate causality analysis. The findings show that at least one way of Granger causality is active for all variables, namely Islamic financing, interest rate, real exchange rate, inflation rate and GDP. At the same time, the error correction for all variables also seems to be negatively significant at least at the 5% level of significance. This implies that the variables appear to bear the brunt of short-run adjustment to long-run equilibrium.

Based on Table 8, it seems that the causation may run from overnight interest rate to real exchange rate to GDP to inflation rate to Islamic financing then go back to overnight interest rate. We also can see the causation from Islamic financing to GDP and return back to overnight interest rate. At the same time, overnight interest rate may also directly affect GDP thereby causing Islamic financing to then turn to the interest rate. In short, it can be seen here that Islamic financing can cause the GDP at least in the short

Table 8. Multivariate causality analysis.

Dependent variable	Independent variable F-statistic					Coefficient
	Δfnc	Δint	Δrex	Δinf	Δgdp	Ecm_{t-1}
Δfnc	–	0.003 [0.954]	0.042 [0.836]	8.151*** [0.006]	5.153** [0.028]	–0.077*** (–3.190)
Δint	4.851** [0.013]	–	1.745 [0.194]	1.484 [0.230]	3.815* [0.058]	–0.207** (–2.551)
Δrex	0.919 [0.407]	5.071** [0.030]	–	1.344 [0.253]	5.220** [0.027]	–0.180** (–2.166)
Δinf	2.318 [0.111]	0.077 [0.782]	2.106 [0.154]	–	3.824* [0.057]	–0.134** (–2.481)
Δgdp	3.806** [0.030]	7.052** [0.011]	3.077* [0.087]	7.979*** [0.007]	–	–0.515*** (–3.869)

Notes: *,**,*** denote significance at 10%, 5% and 1% level respectively.
Figure in the parentheses is t-statistics.
Figure in the bracket is probabilities for the F-statistics.

run, implying that the financing channel can be a conduit for a monetary policy to influence the aggregate demand although the causal effect from interest rate to financing is not significant in this test.

5. Conclusion

The findings suggest clearly that there is monetary transmission through Islamic financing, although it shows only in a short period. Islamic financing seems to be able to influence the output, which reconfirms the existence of its channel. Regarding disaggregate analyses, it suggests that Islamic financing is disproportionate in its distribution. It is found that Islamic financing is unequally distributed to economic sectors in response to monetary policy shock. The most affected sectors for Islamic financing are electricity, gas and water while finance, insurance and business service sectors are the least affected. The findings also found that monetary policy shock and financing shock unevenly affect economic sectors. It seems to show that the mining and quarrying sector is the most sensitive to these two shocks in comparison to the remaining sectors.

The results from the study seem to suggest that Islamic financing channel for monetary transmission exists in case of Malaysia. The cointegration results first indicate that there is long-run relationship among the variables: monetary policy, Islamic financing, GDP, exchange rate and inflation. Based on the ARDL model, it was proved that the interest rate has a significant negative relationship to Islamic financing in the long-run model. In addition, based on the multivariate causality analysis, the study showed that there is a bi-directional causality between Islamic financing and GDP. In the short run, an increase in Islamic financing can significantly cause GDP to increase and vice versa. In the meantime, the long-run model derived from the ARDL model also shows the similar results. To an increase in GDP, Islamic financing also increases in the long run. These evidences seem to imply that while Islamic financing influences economic activities, it is also affected by the fluctuation of the economy. All in all, it could be inferred that monetary transmission through Islamic financing exists in Malaysia. Monetary mechanisms stem from tight monetary policies affecting the quantity of Islamic financing, toward decrease, thereby causing economic activities to decline. Furthermore, the findings also reflect that Islamic banking, as it operates in a dual banking system, is not spared from the interest rate and monetary conditions of the country (Ibrahim and Sukmana, 2011). When interest rate increases, it affects Islamic financing, causing decrease. This clearly shows the behavior of Islamic banking which cannot shun away from the interest rate while its operation delinks from the interest rates.

From the study it could be suggested that in designing monetary policy, the central bank may consider Islamic financing as an alternative or complement channel for monetary transmission since this channel is just as active as the conventional lending channel. This means that the BNM can use monetary policy by influencing Islamic financing to overcome the recession and inflation in the economy (Said and Ismail, 2007). In addition, the study may suggest that Islamic banking follow the pricing strategy in competing with conventional banking, since the evidence shows that Islamic banking experiences similar risks, i.e., interest rate exposure and monetary conditions, as conventional ones (Ibrahim and Sukmana, 2011).

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