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Macroeconomic shocks, fragility and home financing in Malaysia: can rental index be the answer?

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Abstract

Purpose – This study aims to investigate the interactions among macroeconomic variable shocks, banking fragility and home financing provided by conventional and Islamic banks in Malaysia. Identifying the causes of financial instability and the effects of macroeconomic shocks can help to foil the onset of future financial turbulence.

Design/methodology/approach – The autoregressive distributed lag bound-testing cointegration approach, impulse response functions (IRFs) and forecast error variance decomposition are used in this study to unravel the long-run and short-run dynamics among the selected macroeconomic variables and amount of home financing offered by both conventional and Islamic banks. In addition, the study uses Granger causality tests to investigate the short-run causalities among the selected variables to further understand the impact of one macroeconomic shock to Islamic and conventional home financing.

Findings – This study provides evidence that macroeconomic shocks have different long-run and short-run effects on amount of home financing offered by conventional and Islamic banks. Both in the long run and short run, home financing provided by Islamic banks is more linked to real sector economy and thus is more stable as compared to home financing provided by conventional banks. The Granger causality test reveals that only gross domestic product (GDP), Kuala Lumpur Syariah Index (KLSI)/ Kuala Lumpur Composite Index (KLCI) and house price index (HPI) are found to have a statistically significant causal relationship with home financing offered by both conventional and Islamic banks. Unlike the case of Islamic banks, conventional home financing is found to have a unidirectional causality with interest rates.

Research limitations/implications – This study has focused on analyzing the macroeconomic shocks on home financing. However, this study does not assess the impact of financial deregulation and enhanced information technology on amount of financing offered by both conventional and Islamic banks. In addition, it is not within the ambit of this present study to examine the effects of agency costs and information asymmetry.

Practical implications – The analysis of cointegration and IRFs exhibits that in the long run and short run, home financing provided by Islamic banks are more linked to real sector economy like GDP and House Prices (HPI) and therefore more resilient to economic vulnerabilities as compared to home financing provided by conventional banks. However, in the long run, both conventional and Islamic banks are more susceptible to fluctuations in interest rates. The results of the study suggest that monetary policy ramifications to improve banking fragility should focus on stabilizing interest rates or finding an alternative that is free from interest.

Social implications – Because interest plays a significant role in pricing of home loans, the potential of an alternative such as rental rate is therefore timely and worth the effort to investigate further. Therefore, Islamic banks can explore the possibility of pricing home financing based on rental rate as proposed in this study.

Originality/value – This paper examines the unresolved issues in Islamic home financing where Islamic banks still benchmark their products especially home financing, to interest rates in dual banking system such as in the case of Malaysia. To the best of the authors' knowledge, studies conducted in this area are meager and therefore is imperative to be examined.

Keywords Granger causality, Dual banking system, ARDL cointegration, Banking fragility, Home financing, Macroeconomic shocks

Paper type Research paper

1. Introduction

The recent global financial crisis (GFC) has spurred debates in the area credit market volatilities and their link with macroeconomic variables. The crisis also highlights the vulnerabilities of mortgage or home financing market as offered by banks. Credit variations play an important role in enhancing, transmitting and precipitating shocks both during normal times and during financial distress (Schularick and Taylor, 2009). Many researchers identified that the losses of subprime mortgages because of supply contraction led to the worst recession since 1930s and at the same time is also linked to credit boom. Credit boom which refers to a period in which credit extended to the private sector exceeds its long-run trend by more than during a normal business cycle expansion (Schularick and Taylor, 2009). However, not all credit booms result in financial crises as policy makers including central banks try to maintain the ideal levels of credit given the trends and movements in the economy (Mendoza and Terrones, 2008).

Kim and Moreno (1994), Bernanke *et al.* (1999), Calza *et al.* (2001), Borio and Lowe (2002), Hofmann (2004), Gerlach and Peng (2005), Ibrahim (2006), Fitzpatrick and McQuinn (2007), Mendoza and Terrones (2008), Brissimis and Vlassopoulos (2009) and Schularick and Taylor (2009) conducted studies to establish the relationship among credit market, macroeconomic variables and financial crises. This present study seeks to unravel the dynamic relationship of credit market by focusing on fluctuations in home financing provided by conventional and Islamic banks and several macroeconomic variable shocks. It hopes to address the issue of banking sector fragility focusing on home financing or mortgage markets.

The first Islamic bank in Malaysia was established in 1983. Ernst & Young (2013) states that Malaysia's Islamic banking industry is deemed to be a global leader with a growth of six-year compound annual growth rate of 21 per cent and account for 20.7 per cent of total domestic banking market share. Malaysia operates a dual banking system where Islamic banks are operating in parallel with conventional banks. The main difference between Islamic and conventional banks is that, the former operates in accordance with the tenets of *Shariah*, the legal code of Islam, which is asset-based, prohibit interest (riba) and promote risk sharing (Hasan and Dridi, 2010), and in contrast with conventional banks, which operate primarily on interest-based transactions and permit risk transfer mechanism (Shanmugam and Zahari, 2009).

Financing of Islamic banks are expected to be less susceptible to macroeconomic shocks and is therefore more resilient compared to conventional banks because the structures are principled by the prohibition of interest, uncertainties and gambling and are asset-based.

Malaysian households mainly approach financial institutions to finance for homes and other housing-related expenses which accounts a considerable proportion of their family budget. Bank Negara Malaysia [BNM](2014) reports that Malaysians believe that owning or

investing in properties is an important financial goal. Malaysian households registered around 80.9 per cent of their total credit from the banking sector in December 2013 (BNM, 2014). During the same period, purchase of residential properties amounted to 47.1 per cent of total household debt from banking system in Malaysia (BNM, 2014).

In several countries, banks usually grant more loans to households than to firms (Beck *et al.*, 2012). In Malaysia, home financing accounts for 28.1 per cent of total banking system loans as at end of 2014. The growth in bank lending for the purchase of residential properties in 2014 stands at 13.4 per cent compared to the previous year (2013). As banks provide more loans for purchase of residential properties, their exposure to the residential property market also increases. This phenomenon affects the financial stability of the economy and later can be transmitted to banking crises.

During the 2007-2008 GFC, the fragility of subprime mortgage market was intensified and is said to be directly linked to bank credits particularly in the USA (Bianco, 2008; Crotty, 2009; Jickling, 2009; Schularick and Taylor, 2009; McKibbin and Stoeckel, 2010). Studies by Bianco (2008), Crotty (2009), Jickling (2009), Schularick and Taylor (2009) and McKibbin and Stoeckel (2010) argue that changes in macroeconomic variables have resulted in significant rise in home financing which led to credit booms and bust episodes during the financial crisis. Impact of macroeconomic factors such as gross domestic product (GDP), house prices, stock prices and interest rate, among others, are found to be significant determinants of credit booms (Borio and Lowe, 2002; Mendoza and Terrones, 2008; Schularick and Taylor, 2009). However, existing empirical studies conducted on the relationship between credit market and macroeconomic variables produce mixed results based on cross-country and country-specific analyses (Kim and Moreno, 1994; Calza *et al.*, 2001; Gerlach and Peng, 2005; Hofmann, 2004; Ibrahim, 2006; Fitzpatrick and McQuinn, 2007; Brissimis and Vlassopoulos, 2009). Despite the above, studies on emerging economies particularly with the ones with dual banking system are still limited.

This present study seeks to assess the influence of macroeconomic shocks on home financing, particularly the interest rate variable. If interest rate is significantly and importantly affecting home financing in particular, this indeed reflects the vulnerabilities of home financing to interest rates fluctuations. Therefore, an alternative is to be examined and proposed as a benchmark in pricing of home loans. Against this backdrop, we seek to answer the following questions:

RQ1. Is there a significant relationship between macroeconomic variable shocks and fluctuations of home financing amount provided by banks in Malaysia?

RQ2. Do Islamic home loans respond differently to macroeconomic shocks compared to conventional home loans?

RQ3. Lastly, is there a potential alternative to interest rate that can be adopted by Islamic banks in Malaysia?

The next section presents the theoretical underpinnings and literature review, Section 3 discusses the data and methodology. Section 4 analyzes the results, and finally, Section 5 concludes.

2. Literature review and theoretical underpinnings
The issue of banking or financial fragility seems to be very much deliberated especially during and in the aftermath of the recent 2007-2008 GFC. Financial fragility is the vulnerability of a financial system to a financial crisis. Krugman (2011) and Allen and Gale (2004) define financial fragility as the degree to which "[...] small shocks have

disproportionately large effects". Some researchers link financial fragility to banking crises. For instance, Pesola (2007) alludes that systemic episodes of banking crises can often have destabilizing effects on the economy. It is therefore important to understand and anticipate risks of such nature to ensure financial stability.

The term "financial fragility" is also best associated with Minsky's (1975) financial instability hypothesis where it states that capitalist, market economy naturally develops through three phases or states during an upward trend of a business cycle. Each preceding phase involves an increasing degree of financial fragility, where fragility is defined by the relationship between the payment commitments on liabilities and the gross profits generated by assets. Financial instability is most likely to occur when an economy is in its most financially fragile state or, what Minsky referred to as, the "Ponzi" phase.

There is an existing strand of literature which links financial liberation, bank credits and macroeconomic shocks (Gourinchas *et al.*, 1999; Eichengreen and Arteta, 2000; Pesola, 2001, 2007). These studies allude that credit boom resulting from financial liberalization has often been transmitted to banking crises. Macroeconomic shocks precipitated by fluctuations in income (GDP) and interest rates can cause banking fragility (Pesola, 2007).

In this present study, we extend the existing literature by focusing on banking sector variable measured by amount of financing offered by conventional and Islamic banks and investigate how they are impacted by macroeconomic variable shocks, namely, GDP, Kuala Lumpur Composite Index (KLCI)/Kuala Lumpur Syariah Index (KLSI), house price index (HPI) and interest rates. In addition, it also seeks to compare the effects of these shocks in a dual banking system such as the one in Malaysia.

The standard economic theories of financial accelerator, wealth effects and credit view have often been linked to the study of macroeconomic determinants of credit. Financial accelerator is an important tool in aiding to explain an unexpected increase in asset prices. This raises borrowers' net worth and increases the creditworthiness to borrow from banks in the existence of credit market frictions (Bernanke *et al.*, 1999). A wealth effect is defined as the causal effect of exogenous changes in wealth upon consumption behavior (Case *et al.*, 2005). Changes in spending normally reflect a change in perceived wealth. Credit, is often viewed as demand determined and is also affected by household consumption behavior and wealth. Moreover, the cost of financing also affects the demand of households for credit. Bernanke and Gertler (1995) explain that that credit view is a change in monetary policy that increases or decreases open-market interest rates which tends to influence the external finance premium in the same direction.

By definition, a typical housing loan provided by conventional banks which is commonly referred as mortgage is secured by the real property and provides a schedule of payments of interest and repayments of the principal to a bank (Tse, 1997). The contract between the borrower and the conventional bank is a loan contract and the bank has a lien over the property which restricts the ability of the borrower (owner) to sell the property without the bank's permission (El-Gamal, 2006). Islamic banks, on the other hand, offer home financing via *murabahah* (cost-plus sale), *ijarah* (leasing) or *musharakah mutanaqisah* (diminishing partnership).

Another important distinction of conventional home financing is the available recourse of the bank in case the borrower delays in payment. Conventional banks normally impose compounding of interest in cases when the borrower defaults. Additionally, the nature of risk management of home financing provided by conventional and Islamic banks also differ. Conventional banks transfer the risk to the home buyer by requiring an interest payment independent of the return on the investment and/or financial condition of the home buyer. As for Islamic banks, the risk inherent is shared in in the ownership of the property which is a partnership-based financing (Hasan and Dridi, 2010). This view is also supported by

Abdou (2015) who maintains that Islamic financial institutions were relatively more stable than the conventional ones during the GFC.

The legitimacy of home financing from the Islamic world view is rooted from the basic principle of realizing *maqasid al-Shariah* (Ahmad, 2009, 2011). *Maqasid al-Shariah*, as identified by Al-Ghazali, refers to the objectives of Islamic law which encompasses three categories: essentials (*daruriyyat*), complementary requirements (*hajiyyat*) and beautifications or embellishments (*tahsiniyyat*). Essentials comprise five basic elements which are indispensable for the survival of human beings. These objectives of *shariah* include safeguarding of religion (*din*), human life (*nafs*), lineage (*nasl*), wealth (*mal*) and intellect (*aql*). Having a home is in line with the necessity to preserve and protect religion, human life, progeny, wealth and intellect. The objective of achieving basic needs such as shelter, together with food and clothing, is consistent with the theory of motivation by Maslow (1954). In current scenario, in most economies, purchasing a house would be difficult in the absence of home financing provided by banks.

Based on a conducted interview on five prominent scholars, it is unanimously agreed that the use of actual rental value of property as a benchmark brings many benefits such as in the case of *musharakah mutanaqisah* home financing. As such, rental value can be an alternative to interest rate benchmark (Meera and Abdul Razak, 2005). The justifications of proposing rental value include a better reflection of the market condition, capturing true value of the property and a transaction that is free from interest. Although scholars opine that the use of interest rate as a benchmark is permissible, Islamic banking needs to develop its own benchmark (Meera and Abdul Razak, 2005).

Sheikh Muhamad Taqi Usmani (2004) elaborated that rental must also be determined at the time of the contract for the whole leasing period. It is permissible to have rental fixed at different phases of the tenure, provided that the rental amount is specifically determined for a specified tenure and subject to the mutual consent of both the lessor and the lessee. However, if the rental for subsequent phase of tenure is not yet determined at the onset of the first phase of tenure and is left only at the option of the lessor, the lease is therefore considered invalid. This view lends support to that of Wahaba Al-Zuhayli (2003) which concludes that a sale without a price is invalid and thus renting without a price is also considered invalid. It is further highlighted by Wahaba Al-Zuhayli (2003) that a sale should not comprise uncertainty or ignorance, coercion, time restriction, uncertain specification, harm and corrupting conditions (Meera and Abdul Razak, 2005).

Islamic banks in Malaysia offer three most common modes of home financing, namely, *bai bithaman ajil* (BBA) or *murabahah* and *musharakah mutanaqisah*. *Musharakah mutanaqisah* is the more recent mode of financing being offered. BBA is a cost plus sale transaction, while *musharakah mutanaqisah* (decreasing partnership) is an equity-based financing combined with rental (*ijarah*) (Meera and Abdul Razak, 2005; El-Gamal, 2006). Islamic home financing is asset-backed and based on sale or equity transactions rather than just a borrowing and lending contract. Theoretically, Islamic home financing is more linked to real sector of the economy. Moreover, being asset backed, Islamic home financing is less speculative in nature and less susceptible to macroeconomic shocks or financial crises.

Hinging on positive economic activity and negatively related to costs of financing, credit aggregates are essentially assumed to be demand determined (Bernanke and Blinder, 1989; Fase, 1995; Calza *et al.*, 2001). Numerous studies have been undertaken to analyze the determinants of credit because credit markets directly influence the financial stability. Variables such as GDP, interest rates, house prices and stock prices are significant determinants of the total amount of financing (Kim and Moreno, 1994; Calza *et al.*, 2001; Hofmann, 2004; Gerlach and Peng, 2005; Ibrahim, 2006; Fitzpatrick and McQuinn, 2007;

Brissimis and Vlassopoulos, 2009). An attempt to integrate the above variables in a single model has not been fully explored. A more robust estimation of the dynamic relationship between macroeconomic variables and credit would be achieved by integration of lending rates, measure of real aggregate activity and asset prices. Calza *et al.* (2001) and Fitzpatrick and McQuinn (2007) suggest a refined model of behavior of credit demand by having a sectorial breakdown of total credit such as financing for purchase of residential properties of households.

Currently, there is no clear consensus in the literature that the demand of credit of households is being influenced by the real economic activity which is measured by GDP (Calza *et al.*, 2001). Economic activity reflects the economic conditions, which positively affect the consumption and investment demand of households. Hence, that economic activity is viewed as having a positive effect on demand for credit. Conversely, a negative relationship between GDP and credit demand percolates when households reduce their debt levels subsequent to the increase in current productivity, which resulted in the increase of output and profits (Bernanke and Gertler, 1995). Likewise, during the downturn of economic activity and decline in income, the demand for credit spikes upward to mitigate the impact of reduction in income and profits. The concern of financial instability precipitates when credit increases during economic activity slowdown. This is because, the probability of bank default increases with impairment of households' ability to service their loans commitments which leads to higher non-performing loans and consequently affects banking or financial fragility. Coupled with the increase in mortgage default and abrupt drop of house prices, the recent global crisis worsens and later turns to financial crisis (Crotty, 2009).

Calza *et al.*'s (2001) study from 1980 to 1999 in the euro area find that GDP has long-run positive relationship with real loans. Hofmann (2004) echoes Calza *et al.* (2001) for 16 industrialized countries. Similar long-run positive relationship between GDP and credit was documented by Gerlach and Peng (2005) who conducted their study in Hong Kong using data from 1982 to 2001, and Brissimis and Vlassopoulos (2009) conducted their study in Greece using data from 1993 to 2005. By using impulse response functions (IRFs) analysis to unlock the short-run dynamics of GDP and credit, Kim and Moreno (1994) and Ibrahim (2006) find inconsistent results. Kim and Moreno (1994) find that GDP has a negative impact on credit based on credit fluctuations data from 1970 to 1993 in Japan. Conversely, by using IRFs analysis, Ibrahim (2006) documents evidence that GDP is positively correlated to bank loans in Malaysia for the period running from 1978 to 1998.

A HPI is used to measure the current trends of residential house prices for a geographic not larger than country or metropolitan area because housing markets are geographically localized (Case *et al.*, 1991). The relationship between house prices and credit is triggered by the interest on the causes, effects, regulatory measures, etc., during the recent financial crisis. Bianco (2008), Jickling (2009), McKibbin and Stoeckel (2010) and Schularick and Taylor (2009) argue that the crisis triggered because of rapid increases in the prices of real property to unsustainable levels which result in housing bubbles. Fitzpatrick and McQuinn (2007) find that there is a mutually reinforcing long-run relationship between domestic bank credit and house prices and also house price influences credit less than credit influences house price in Ireland. The finding is not consistent Gerlach and Peng (2005), who find that bank lending adjusts to house prices in Hong Kong, and not the other way around. Bank lending does not affect property prices, instead bank lending is influenced by house prices.

By incorporating cointegration analysis and error-correction models, Brissimis and Vlassopoulos (2009) provide evidence that in Greece, there is a positive long-run relationship between house prices and housing loans. Brissimis and Vlassopoulos (2009) further postulate that housing prices do not adjust to disequilibria in the market for housing loans

which indicates that housing prices is not affected by the long-run mortgage lending. However, in the short run, they find evidence of a contemporaneous bi-directional dependence between these two variables. From a cross-country analysis, Hofmann (2004) finds that in 14 of 16 countries, there exists a long-run positive relationship between credit and property prices. He alludes that significant and persistent cycles in bank lending are because of innovations in property prices through the changing beliefs about future economic conditions or speculation in property markets.

A stock market index is a statistical indicator intended to measure and report the changes in the market value of a group of stocks. It is an aggregate value of the selected stocks and is normally expressed as the percentage change of the total values of the stocks against a base value from a specific date. Stock price indices are normally grouped based on some screening methodologies. With the advent of Islamic banking, *Shariah*-based screening methodologies are now being applied. Kim and Moreno (1994) reiterate that stock prices positively influence credit in two ways. First, fluctuations in stock price affect loan demand by reflecting changes in future economic activities. Decreasing stock prices may signal contraction in the stock market which influences lower loan demand and spending, as the economy is perceived to be slowing down. Second, fluctuations in stock prices influence the supply of loan by affecting the capital position of banks. Depending on the equity exposure, banks may be keen to lend more when there is an upward trend in stock prices and reduce lending of loans when stock prices reduce. Banks normally use capital gains on stocks to mitigate the effects of adverse shocks to assets. Meanwhile, households consider stocks and real estate as substitute investments. Demand for loans is based on future expectations of risks and returns on stocks. Hence, households tend to invest more in equities in real estate, when stock price increases.

Borio and Lowe (2002) and Schularick and Taylor (2009) further assert the probability of an episode of financial instability risk increases during asset price boom (i.e. rapid increase in property and stock prices) and rise in bank lending. Kim and Moreno (1994) find that the response of loans to shocks in the stock price is positive in Japan while investigating the contributions of stock price movements to credit fluctuations. This finding is consistent with the study of Ibrahim (2006) who finds that bank loans positively react to the rise in stock prices, but stock prices are not affected by banks loans.

An important determinant of credit is interest rate as the cost of financing as highlighted in the literature. This present study uses overnight policy rate (OPR) to capture the effects of interest rate on home financing. OPR is the tool deployed by the BNM as the target rate for day-to-day liquidity operations and to signal monetary policy stance. Interest rate should not influence the financing activities of Islamic banks because Islamic banks are not engaged in interest-related activities. Exiting studies of conventional banks document a negative relationship between interest rate and home financing. Loans become more expensive because of an increase in interest rates, and thus, demand for loans decreases. Low interest rate would induce borrowings (Bianco, 2008; Crotty, 2009; Jickling, 2009; McKibbin and Stoeckel, 2010), which later can be manifested in the 2007-2008 financial crisis. During 2001-2004, US Federal Reserve set low interest rates, which attracted many people to purchase houses, causing the prices of houses to escalate.

Hofmann (2004) finds a negative and significant relationship between interest rate and credit in 9 out 16 countries, whereas Fitzpatrick and McQuinn (2007) posit that a long-run positive relationship exists between interest rate and credit. This may be because of the relatively high correlation of mortgage rates with other market interest rates such as deposit

rates. Similarly, Ibrahim (2006) echoes the study of Fitzpatrick and McQuinn (2007), which concludes a positive correlation between interest rate and credit in the short run.

Kassim *et al.* (2009) find that contrary to the general expectations, Islamic banks' loans and deposits are relatively more sensitive to changes in monetary policy measured by OPR set by BNM. The study uses IRFs and variance decomposition analysis based on vector autoregression (VAR) to assess the impact of monetary policy shocks on conventional and Islamic banks in Malaysia for the period of January 1999 to December 2006.

Table I provides a summary of past studies that have investigated the dynamic relationship of macroeconomic variables and home financing. It is apparent that the findings of these studies on the relationship of macroeconomic variables and home financing are mixed. Moreover, most of these studies have focused on industrialized countries and conventional banks. In comparison to other studies, especially to Ibrahim (2006) who conducted the study on Malaysia, the present study fills the gap in the literature by incorporating the following:

(1) home financing and not larger credit aggregate is used as dependent variable;

(2) house prices and *Shariah*-compliant stock index are included in the equation/ model; and

(3) the relationship between macroeconomic variables and home financing is analyzed for both conventional and Islamic banks for a more recent period of analysis covering quarterly data from 2007 to 2014.

Based on Table I, interest rate seems to be one of the most significant macroeconomic determinants of credit market across countries with varying time periods and methodologies. This present study extends the analysis by examining the credit market fragility measured by variations of amount of financing by banks to macroeconomic shocks with a view to propose an alternative benchmark for pricing of home loans.

More recently, Ghauri (2015) posits that, in general, conventional interest rates like London Interbank offered rate, Euro Interbank offered rate, Kuala Lumpur Interbank offered rate and Karachi Interbank offered rate (KIBOR) are regarded as benchmarks for pricing of Islamic financial products. It is argued, however, that interest rate benchmarking in an interest-free financial system cannot be regarded as a reference point because Islamic finance contracts are not dependent on time, amount or even agreement terms. Based on cross-countries analysis like Bangladesh, Indonesia, Iran, Oman and Pakistan, Ghauri (2015) further documents empirical evidence that real economic activities can only be represented by a composite of real economic indicators such as GDP, money supply and investment. Therefore, using a single variable such as interest rates will not truly capture the real sectors of the economy. In the case of Pakistan, Ghauri (2015) concludes that KIBOR cannot be used as a benchmark because of its inability to reflect overall real economic activity and thus cannot be used for pricing Islamic financial products.

Study by Al-Muharrami (2015) complements that of Ghauri (2015) on the limitation of using interest rates as a benchmark. In assessing the components of interest rates in the case of Oman, Al-Muharrami (2015) alludes that interest rates' risk may affect the bank's net income. For instance, increasing interest rates lowers bank's profit margin in cases where the interest paid on deposits increases rapidly than interest revenues imposed on loans or financing activities. In this case, the volatilities in interest rates can be seen as a destabilizing factor in pricing of home loans.

Research	Country	Dependent variable	Independent	Period	Methodology	LR/SR	Relationship to credit			
							GDP	HP	SP	IR
Brissimis and Vlassopoulos (2009)	Greece	Housing loans	GDP, residential property prices and variable mortgage interest rate	1993 Q4 to 2005 Q2	VECM, OLS with Hausman test	LR SR[a]	+	+		∓
Calza, et al. (2001)	Euro area	Bank loans	GDP, short-term and long-term interest rates	1980 Q1 to 1999 Q2	Johansen Cointegration, VECM	LR SR	+			∓
Fitzpatrick and McQuinn (2007)	Ireland	Housing loans	After-tax disposable income per household, new house prices and mortgage interest rate	1980 Q1 to 2002 Q4	Dynamic OLS method, OLS with Hausman test	LR SR	+	+		+
Gerlach and Peng (2005)	Hong Kong	Bank loans	GDP and property prices	1982 Q1 to 2001 Q4	Johansen Cointegration	LR SR	+	+		
Hofmann (2004)	16 industrialized countries	Bank loans	GDP, aggregate property prices and interest rates	Quarterly, 1980 to 1998	Johansen Cointegration, VECM, IRF	LR SR	+ +	+ +		∓ ∓
Ibrahim (2006)	Malaysia	Bank loans	GDP, stock prices, (consumer) price level, interest rate and exchange rate	1978 Q1 to 1998 Q2	Johansen Cointegration, IRF	LR SR	+		+	+
Kim and Moreno (1994)	Japan	Bank loans	Industrial production, consumer price index, Nikkei stock average and call money rate	Jan. 1970 to May 1993	VAR, IRF, FEVD and forecast error	LR SR	∓		+	−

Notes: LR = long run; SR = short run; SP = stock prices; HP = house price; IR = interest rates; [a]there is contemporaneous bi-directional dependence between housing loans and housing prices; + indicates a positive correlation with the dependent variable; − indicates a negative correlation with the dependent variable

Table I.
Summary of past studies on macroeconomic determinants of credit

3. Data and methodology

The Table II summarizes the data and variables used in this present study.

This present study adopts the view of Kim and Moreno (1994) which incorporates real output, price level and interest rate into the analysis of credit. The purpose is to capture cyclical factors that may affect bank lending behavior.

Ideally, for the purpose of this study, all variables are to be incorporated in a single model. However, having a finite sample, the model can be poorly estimated, as the addition of a variable will quickly exhaust the degree of freedom (Kassim *et al.*, 2009). Thus, separate models are estimated. The ARDL models used in this study can be expressed as the following general models:

$$HFC_t = \alpha_0 + \alpha_1 GDP_t + \alpha_2 HPI_t + \alpha_3 KLCI_t + \alpha_4 OPR_t + e_t \tag{1}$$

$$HFI_t = \alpha_0 + \alpha_1 GDP_t + \alpha_2 HPI_t + \alpha_3 KLSI_t + \alpha_4 OPR_t + e_t \tag{2}$$

where *HFC* and *HFI* refer to conventional home financing and Islamic home financing, measured by the amount of financing offered by conventional and Islamic banks, respectively. The selected macroeconomic variables are real *GDP*, *HPI* which refers to Malaysian House Price Index, *OPR* set by BNM, *KLCI* and *KLSI* representing conventional and Islamic stock price indices, respectively. Except for *OPR*, all series are transformed into natural logarithms.

Consistent with previous studies, the above models assume that credit is demand determined, although the observed credit developments are produced by the interaction of both supply and demand. Therefore, it is not implausible that supply factors also influence home financing developments.

We start our analysis by testing the stationarity of the variables in the selected models using unit root test and later estimate of long-run dynamics of the variables via ARDL cointegration test.

To examine the short-run interactions among macroeconomic fluctuations and both the conventional and Islamic home financing, this study also uses IRFs and forecast error variance decomposition (FEVD) based on VAR model. Table III summarizes the time

Variables	Measurement	Period	Sources
Conventional home financing	Amount of home financing provided by commercial banks (HFC)	1Q 2007 to 2Q 2014	BNM Monthly Statistical Bulletin
Islamic home financing	Amount of home financing provided by Islamic banks (HFI)	1Q 2007 to 2Q 2014	BNM Monthly Statistical Bulletin
Gross domestic product	Gross domestic product, 2005 constant prices, seasonally adjusted (GDP)	1Q 2007 to 2Q 2014	Oxford Economics
House prices	Malaysian house price index (HPI)	1Q 2007 to 2Q 2014	Department of Statistics, Malaysia
Stock prices of conventional stocks	FTSE Bursa Malaysia Kuala Lumpur composite index (KLCI)	1Q 2007 to 2Q 2014	FTSE
Stock prices of *Shariah*-compliant stocks	FTSE Bursa Malaysia EMAS *Shariah* – Price Index (KLSI)	1Q 2007 to 2Q 2014	FTSE
Interest rate	BNM Overnight Policy Rate – Middle Rate (OPR)	1Q 2007 to 2Q 2014	BNM Monthly Statistical Bulletin

Table II.
Measurement of variables

series analysis techniques used in this study that correspond to the identified research objectives.

3.1 Unit root test

To avoid spurious regression, this study conducts unit root tests for stationarity of variables and uses Augmented Dickey–Fuller to test for the presence of unit roots in our selected variables. Unit root test is used to verify whether a variable is stationary at level, $I(0)$, or stationary at first differencing, $I(1)$. The variable is regarded as non-stationary if unit root exists in the system and thus requires differencing to solve this issue.

3.2 ARDL bound testing cointegration approach (long-run analysis)

To test for long-run relationships among macroeconomic shocks and credit fluctuations measured by amount of financing offered by both Islamic and conventional banks, we further extend our analysis to test the presence of the cointegrating relationships between macroeconomic variables and both conventional and Islamic home financing. Here, we use the two-step residual-based procedure by Engle and Granger (1987) and later use the system-based reduced rank regression approach of Johansen (1991), and finally, we adopt the autoregressive distributed lag (ARDL by Pesaran *et al.*, 1996) for cointegration analysis. ARDL models are most appropriate for studies conducted on small and finite samples and are robust against simultaneous equation bias and autocorrelation problem. This approach requires that the underlying variables are integrated of order $I(0)$ or $I(1)$. This deliberately requires pre-testing, which may induce a degree of uncertainty and can also affect the analysis of long-run relationships. We estimate using a model selection process such as the Akaike Information Criterion or Schwarz–Bayesian Criterion (SBC). Our empirical models are expressed as follows:

$$
\begin{aligned}
\Delta \ln HFC_t = a_0 &+ \sum_{j=1}^{k1} b_j \, \Delta \ln HFC_{t-j} + \sum_{j=0}^{k2} c_j \Delta \ln GDP_{t-j} + \sum_{j=0}^{k3} d_j \Delta \ln HPI_{t-j} \\
&+ \sum_{j=0}^{k4} e_j \Delta \ln KLCI_{t-j} + \sum_{j=0}^{k5} f_j \Delta \, OPR_{t-j} + n_1 \ln HFC_{t-1} + n_2 \ln GDP_{t-1} \\
&+ n_3 \ln HPI_{t-1} + n_4 \ln KLCI_{t-1} + n_5 OPR_{t-1} + \epsilon_t
\end{aligned}
\tag{3}
$$

Research questions	Methodology
RQ1. Is there a significant long-run relationship between macroeconomic variable shocks and home financing in Malaysia	ARDL (Bound Testing Cointegration Approach)
RQ2. Do Islamic home loans respond differently to macroeconomic shocks compared to conventional home loans?	Impulse response function Variance Decompositions
RQ3. What is the influence of each macroeconomics shocks on banking fragility measured by fluctuations in the amount of financing offered by both conventional and Islamic banks?	Granger causality

Table III.
Research objectives and methodology used

$$\Delta \ln HFI_t = a_0 + \sum_{j=1}^{k1} b_j \Delta \ln HFC_{t-j} + \sum_{j=0}^{k2} c_j \Delta \ln GDP_{t-j} + \sum_{j=0}^{k3} d_j \Delta \ln HPI_{t-j}$$

$$+ \sum_{j=0}^{k4} e_j \Delta \ln KLSI_{t-j} + \sum_{j=0}^{k5} f_j \Delta OPR_{t-j} + n_1 \ln HFI_{t-1} + n_2 \ln GDP_{t-1} \tag{4}$$

$$+ n_3 \ln HPI_{t-1} + n_4 \ln KLSI_{t-1} + n_5 OPR_{t-1} + \epsilon_t$$

Wherein the short-run dynamics are represented by the terms with the summation signs, while the long-run relationship is represented by second part and expressed by variables without the summation signs. ϵ_t refers to the random error term. The ARDL procedure allows simultaneous testing for long- and short-run dynamics, which is relevant for the estimation of the equilibrium conditions.

The bound testing starts with testing for the presence of cointegration or long-run relationship among the variables based on estimating error correction models (ECMs). Once confirmed of the long-run relationships, we then estimate the long-run coefficients of the variables associated with ARDL ECM. Finally, for robustness checks, diagnostic and stability tests are performed to determine the goodness of fit of the ARDL models.

Based on Narayan (2005), the joint significance using F-statistics used in ARDL bound testing approach can be compared to two sets of critical values of bound. The first set assumes that all the independent variables are $I(1)$, while the set assumes that they are all $I(0)$. The null hypothesis that there is no cointegration among the variables is rejected if the computed value of F-test exceeds the upper bound. On the other hand, the null hypothesis cannot be rejected if the computed value F-test is less than the lower bound. If the computed value F-test falls within the upper and lower bound, then the result becomes inconclusive. If this occurs, then the order of integration, $I(d)$, for the explanatory variables has to be ascertained before any conclusion is made. The model selection of this study is carried out using SBC because it is more parsimonious with the lag length selection and is a consistent model selection criterion (Pesaran and Shin, 1999).

The ECM coefficient shows the speed of adjustment process to restore equilibrium following a disturbance in the long-run equilibrium relationship. A significant negative ECM coefficient suggests how disequilibrium is corrected in the next quarter. A relatively high ECM coefficient in absolute amount indicates a quicker adjustment process. We then perform structural stability tests using cumulative sum of recursive residual (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) to ascertain the stability of our empirical models. If the plots of CUSUM and CUSUMSQ tests are established within the critical bounds of 5 per cent significance level, we conclude that our models are stable, and on the contrary, if the lines are found to be crossed, the stability of coefficients is then rejected. For our present study, the null hypothesis that all coefficients in the ECMs, as in the ARDL models for HFC and HFI, are stable and cannot be rejected if the plots of the CUSUM and CUSUMSQ statistics are established within the 5 per cent critical bounds.

3.3 Impulse response function and forecast error variance decomposition (short-run analysis)

IRFs and variance decompositions are used in our short-run analysis to observe the relationship between macroeconomic shocks and credit fluctuations of home financing in a higher dimensional system. If a significant response of home financing variable to

macroeconomic shocks exists, a causal relationship from macroeconomic shocks to credit fluctuations is established. Meanwhile, IRF measures the dynamic marginal effects of each shock on all of the variables in the system over a period of time. FEVD, on the other hand, examines how strongly each of the shocks affects the overall, unpredictable variance of each of the selected variables over time.

Based on VAR methodology, this study adopts IRF and FEVD analysis techniques to empirically explore the impact of shocks in macroeconomic variables (i.e. GDP, house prices, stock prices and interest rate) on home financing provided by conventional and Islamic banks.

When using IRF and FEVD following VAR model, it is important to solve identification problem by using Sims' (1980) strategy of orthogonalizing the shocks via Cholesky decomposition. Orthogonalizing the VAR's shocks is critical to avoid the shocks of one variable to be transmitted through the contemporaneous correlation with shocks in other variables in the system. The ordering adopted for this study is similar to Hofmann (2004), which is depicted as follows: real GDP, house prices, stock prices, home financing and interest rate. This ordering assumes that real GDP does not respond contemporaneously to shocks to any of the other variables, but may influence all other variables within quarter. This is the common standard assumption in the monetary policy transmission literature. In addition, we assume that property and stock prices are rather sticky such that they are not contemporaneously affected by home financing and interest rate. Interest rate is considered fexible and therefore is permitted to respond within quarter to shocks to real GDP, property prices, stock prices and home financing. Consistent with Hofmann (2004), the chosen ordering also captures the typical assumption that changes in interest rates are transmitted to the economy with a lag.

For robustness check, this study also performed:

- generalized IRF; and
- IRF based on another Cholesky ordering of variables: home financing, interest rate, house prices, stock prices and GDP.

The generalized IRF is adopted to resolve the ordering problem inherent in the orthogonalized impulse responses (Koop *et al.*, 1996; Pesaran and Shin, 1998). The historical patterns of correlations among different shocks in generalized IRF approach are fully incorporated, allowing the impulse responses to be unique and hence invariant to the orderings of the variables. Meanwhile, we also performed a second set of ordering, premised on the other view that home financing is expected to have the strongest response to its own shock, followed by the shocks in interest rate, house prices, stock prices and GDP.

3.4 Granger causality
Causality test was first propounded by Engel and Granger. The purpose of Granger causality is to examine whether a macroeconomic shock (A) precedes home financing variable (B), or B precedes A, or the relationship between A and B is that of reciprocity. This relationship of causality can occur between the two selected variables. Granger causality test aims to look at the past influence of a conditions variable against other variables in the present. In other words, in our present study, the Granger causality tests can be used to see if each of the macroeconomic variable shocks (Y) can more accurately forecast home financing variable (X) by entering its lag.

There are four possible outcomes that are obtained from the Granger causality test as follows:

(1) if $\Sigma aj \neq 0$ and $\Sigma bj = 0$, then there is one-way causality from x to y;

(2) if $\Sigma aj = 0$ and $\Sigma bj \neq 0$, then there is one-way causality from y to x;

(3) if $\Sigma aj = 0$ and $\Sigma bj = 0$, then there is no causality relationship of between x and y; and

(4) if $\Sigma aj \neq 0$ and $\Sigma bj \neq 0$, then there are two-way causality between x and y.

4. Findings and analysis

4.1 Results of unit root test

We start our analysis by presenting the results on unit root tests as evidenced in Table IV. Our results generally suggest that all variables are stationary at 10 per cent significance level. Although, ARDL does not require all variables to be stationary, we provide the results as preliminary tests to perform the long-run cointegration analysis.

The results further justify the use of ARDL model as Pesaran *et al.* (1996) suggest that ARDL approach can reliably test hypotheses on coefficients in which the variables are integrated of either order 0 or 1.

4.2 Results of ARDL model approach

The next step involves testing for long-run dynamics between the selected macroeconomic variables and home financing offered by both conventional and Islamic banks. By adopting the SBC for model selection, a maximum number of three lags was chosen on the basis that the data are quarterly in nature with small and finite number of observations.

Table V presents results on the ARDL model selected by SBC and *F*-statistics for HFC and HFI empirical models.

Table V presents the computed *F*-statistics for both models and therefore suggest that cointegrating relationships exist among macroeconomic shocks and credit (home financing) variations offered by both conventional and Islamic banks at the selected lag length. This finding lends support to that of Ibrahim (2006) who finds cointegrating relationship between conventional credit and macroeconomic variables.

	Null hypothesis: There is unit root		
Variables	At level	At 1st difference	Results at 10%
HFC trend and intercept	−2.029	−3.5790* I (1)	
HFI	Trend and intercept	−4.9354***	−2.4211I (0)
GDP	Trend and intercept	−2.6728	−4.1902** I (1)
HPI	Trend and intercept	−1.9527	−5.1696*** I (1)
KLCI	Trend and intercept	−3.2513*	−3.5679* I (0)
KLSI	Trend and Intercept	−3.0266	−3.8256**I (1)
OPR	Intercept	−2.1551	−4.0358*** I (1)
At level:			
T-critical (trend and intercept) at 10%		−3.2253	
T-critical (intercept) at 10%		−2.6251	
T-critical (trend and intercept) at 10%		−3.2253	
T-critical (intercept) at 10%		−2.6251	

Notes: ***Significant at 1% level; **significant at 5% level; *significant at 10% level

Table IV.
Summary of unit root tests

We now proceed to estimate the long-run coefficients of ARDL models for HFC and HFI. As evidenced in Table VI, KLCI and OPR have significant long-run relationship with HFC, while GDP, HPI and OPR are significant determinants of HFI in the long run. The subsequent discussions focus first on the individual variable of each ARDL model before a general analysis is presented.

For HFC model, we find that in the long run, KLCI is negatively related to HFC, while OPR is positively related to HFC. The negative coefficient of KLCI means that with 1 per cent increase (decrease) in KLCI, HFC decreases (increases) by 0.054 per cent. Accordingly, the positive coefficient of OPR means that with 1 per cent increase (decrease) in OPR, HFC increases (decreases) by 0.036. The result for KLCI suggests that households treat stocks as an alternative investment to housing market investment, and when stock prices increase, households seem to prefer to hold equity shares which yield dividends rather than take additional housing loans to own homes which they can subsequently lease to earn rent income. Accordingly, the same can be said when stock prices decrease. High stock market volatility especially in times of economic downturn may push away households from placing their funds into equities and unit trusts. As shown in Figure 1, stock prices represented by KLCI were very volatile from first quarter of 2007 to fourth quarter of 2008 as the effects of the financial tumult in the USA remain to shake financial markets around the globe. However, regulations by the Malaysian government have ensured that the collapse in exports during the global crisis resulting in a contraction in aggregate demand did not generate a bearish run on the stock market (Abidin and Rasiah, 2009). In 2009, Bursa Malaysia has remained fairly stable.

The households' preference to invest in equity shares is consistent with the findings of BNM regarding the composition of households' balance sheet. According to BNM (2014), the composition of the assets held by households has become more diversified where it is found that the accumulation of assets in equities and unit trust funds has been rising although

Cointegration hypotheses	F-statistics
F(HFC, GDP, HPI, KLCI, OPR)	7.8160***
F(HFI, GDP, HPI, KLSI, OPR)	9.1683***

Notes: F-statistics exceeds the ***1% upper bounds; the relevant critical value bounds are taken from Narayan's (2005) Appendices A1-A3 for Case IV: with unrestricted intercept and restricted trend; number of regressors = 4, number of observations = 30. They are 5.205-6.640 at the 99% significance level, 3.715-4.878 at the 95% significance level and 3.097-4.118 at the 90% significance level
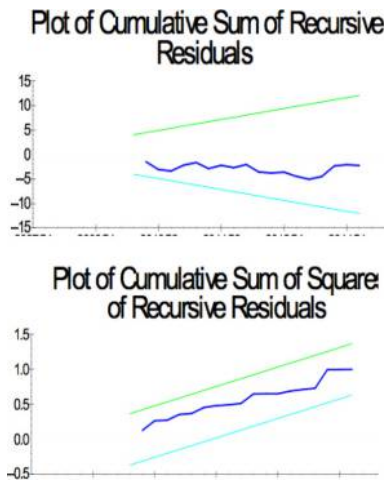
Table V.
Bound-testing procedure results

Regressors	HFC model	T-ratio	HFI model	T-ratio
GDP	−0.0198	−0.1477	−2.195**	−2.2249
HPI	−0.0984	−1.1193	1.3303***	5.274
KLCI	−0.0541**	−2.1045	N/A	N/A
KLSI	N/A	N/A	−0.1363	−0.5975
OPR	3.6640***	4.3221	12.6367*	2.0121
C	26.9366***	8.7618	74.3028**	2.0121
T	0.0282***	17.7091	0.0563***	4.0289

Notes: ***Significant at 1% level; **significant at 5% level; *significant at 10% level

Table VI.
Long-run ARDL model estimates

Plot of Cumulative Sum of Recursive
Residuals

Plot of Cumulative Sum of Square:
of Recursive Residuals

Figure 1.
CUSUM and
CUSUMSQ tests for
HFC model

housing wealth continues to be the largest component of household assets. The relative
lower fund needed to invest in equities and unit trust funds investments as compared to
acquiring a house through home financing and servicing installment payments may also
contribute to increased preference for investment in financial assets. A corroborating data
from BNM (2014) shows that 84 per cent of housing loan borrowers actually have only one
outstanding housing loan account, which implies that bulk of house purchases continued to
be for own occupation and medium- to long-term investment rather than for active leasing to
earn rental income. The growing diversification of household assets does not only reflect the
development in financial markets offering a wider range of products and services, but it is
also attributable to the growing sophistication and improving awareness of alternative
savings instruments for households. After the 2007-2008 financial crisis, the equity market
in Malaysia has exhibited favorable performance which supported the value of financial
assets (Alias *et al.*, 2014). The positive equity market performance seems to have contributed
to the increased acquisition of equities and unit trust funds among households relative to
house investment through home financing.

The positive relationship of OPR and HFC may not be surprising at all. Existing studies
on credit demand and interest rate find a negative long-run relationship and thus concur
with the credit view of monetary policy transmission (Bernanke and Gertler, 1995; Calza
et al., 2001; Hofmann, 2004). A positive relationship of OPR and home financing is also likely
to occur because of the high correlation of OPR and deposit rate provided by banks
(Fitzpatrick and McQuinn, 2007). This means that as OPR increases, deposit rate also
increases, which can attract more savings from depositors. Increased deposits held by banks
allow them to offer more credit, thus potentially increasing home financing amount to be
offered. This is consistent with the study of Kassim *et al.* (2009) who find that there is a
significant positive relationship between OPRs and deposits in conventional banks in
Malaysia. It is also observed that the OPR and interbank overnight deposit rate in Malaysia
during 1Q 2007 to 2Q 2014 move closely together (BNM, 2014).

The long-run estimate for HFI model shows that in the long run, GDP is negatively
related to HFI, while HPI and OPR are positively related to HFI. The negative coefficient
GDP means that 1 per cent increase (decrease) in GDP causes HFI to decrease (increase) by
2.195 per cent. On the other hand, the positive coefficient of HPI means that for 1 per cent

increase (decrease) in HPI, HFI increases (decreases) by 1.330 per cent, while for 1 per cent increase (decrease) in OPR, HFI increases (decreases) by 0.126.

Our results on the relationship between GDP and both HFC and HFI suggest that when GDP increases (decreases), the demand for both Islamic home financing and conventional financing decreases (increases). However, it is interesting to note that only HFI bears a significant relationship with GDP compared to HFC. This finding also infers that HFI is more linked to the real sector of the economy, namely, GDP as opposed to HFC. The findings augur well with the observation by Bernanke and Gertler (1995), which asserts that in times of economic growth and higher income, households tend to improve their balance sheet by reducing their debt levels and rely more on their internal sources of finances to meet their consumption and investment needs. However, when the economy contracts, there seems to be a general decline in income, and in turn, households spend more on their needs and therefore require more financing from banks. This finding is further substantiated by the fact that demand for home financing from Islamic banks has actually increased when GDP growth falls in the last quarter of 2008 and first two quarters of 2009 (BNM, 2014).

Based on Table VI, the HPI is positive and more significantly correlated with HFI compared to HFC and thus suggests that HFI is also more linked to actual value of the assets or housing market compared to HFC. These findings on HFI lend support to the theory on financial accelerator and wealth effects on household behavior to consume and invest. When property price increases, households' net worth increases because of higher valuation in real property assets. Similar to conventional banks, real property assets used as collateral in debt-based financing modes are important for Islamic banks to mitigate risks arising from information asymmetry (Ayub, 2007). Thus, higher collateral value allows potential borrowers to obtain more credit from banks. Consistent with the findings of Hofmann (2004), increases in residential property prices seem to affect demand for home financing via wealth effects.

Contrary to general expectations that Islamic banks are not affected by interest rates, the findings of this study show that OPR is positively related to both HFI and HFC. The positive relationship of OPR and HFI can be indirectly explained by the high correlation found between Islamic investment rates and the conventional deposit rates on a maturity-matched basis in Malaysia (Chong and Liu, 2009). Chong and Liu (2009) further elaborate that in the case of HFC, the deposit rate provided by conventional banks is highly correlated to OPR. This present study concurs with the view that Islamic investment rates are also highly correlated with OPR. This means that when OPR increases (decreases), Islamic investment rates also increase (decrease). High investment rates will attract more investment funds from depositors, thus increasing the ability of Islamic banks to provide more home financing.

The long-run ARDL model estimates for the macroeconomic determinants of home financing provided by conventional and Islamic banks are presented in Table VI above. In the long run, OPR is significant and positively related to home financing provided by both conventional and Islamic banks. However, although the direction is similar, the magnitude of significance differs. Islamic banks seem to be less affected by OPR than conventional banks, as it is only significant at 10 per cent significance level. This echoes the findings of Kassim et al. (2009), which document evidence that Islamic banking industry is still underdeveloped and has limited options to do business as compared to the conventional banking industry, which is more developed and linked with the international markets. HFI is significantly affected by the HPI. However, the same cannot be said for HFC. This is justified by the predominant use of *murabaha* or cost-plus-mark-up credit sale contracts in Islamic home financing. For *murabaha* transaction, the cost price of the house should be

disclosed by banks providing the financing (Ayub, 2007). House price, therefore, significantly influences households' decision to obtain home financing. On the other hand, the requirement to disclose the actual cost or house price is not applicable for conventional home financing. We can also infer that Islamic home financing is more linked to the actual value of the property and thus should not be influenced by macroeconomic shocks, especially the interest rates volatility. Moreover, because *murabaha* contract is a *trust*-based contract, full disclosure allows parties to decide with free will and confidence (Ayub, 2007). In addition, this underscores the advantage of Islamic home financing as not only that it is linked to the true value of the property, but also that it reflects market conditions. Finally, our results also suggest that while KLCI and HFC are negative and significantly correlated, there seems to be no significant relationship between KLSI and HFI. This is plausible, as the households' risk-averse appetite on equity investments may differ depending on the economic conditions of a country. Nurhanani *et al.* (2012) find that during the economic downturn from 2007 to 2010, Islamic stock market index has higher volatility than conventional composite stock index.

Table VII presents the ECM coefficients of ARDL models for HFC and HFI. The ECM coefficients for both models carry the correct negative signs and at the same time are significant. The speed of adjustment process to return to equilibrium is slightly faster for macroeconomic shocks and home financing provided by Islamic banks. The HFI model suggests that 43.89 per cent of the disequilibrium of the previous quarter's shocks adjusts back to the long-run equilibrium in the current quarter. For HFC model, 42.80 per cent of the disequilibrium in the previous quarter is corrected in the next quarter. This, in a way, highlights that Islamic banking tends to be more stable as the disequilibrium in the system is faster corrected (43.89 per cent) compared to conventional banking (42.80 per cent).

The final step in estimating the ARDL model approach is to test the stability of the long- and short-run dynamics of the ARDL models for HFC and HFI. Based on Figures 1 and 2, the CUSUM and CUSUMSQ tests for both models suggest no evidence of any significant structural instability.

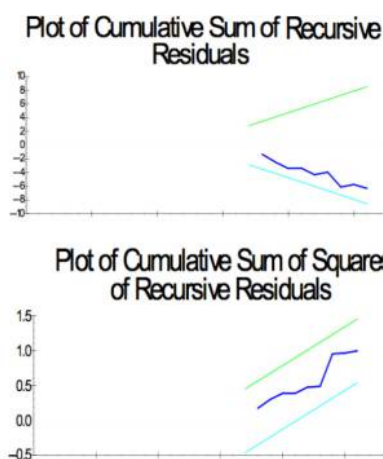### 4.3 Results of impulse response functions
We further extend our analysis on the IRFs based on the selected ordering of GDP, house prices, stock prices, home financing and interest rate. The impulse responses of HFC and HFI attributable to macroeconomic shocks are presented in Figures 3 and 4, respectively. It is interesting to note that, in the short run, the responses of home financing provided by both conventional and Islamic banks to macroeconomic variables are not statistically significant. This is indicated by the graphical representations in Figures 3 and 4 where all impulse response bands cover the vertical line of origin (value = 0).

For robustness check, this study also performed generalized IRF and IRF based on another Cholesky ordering of variables, i.e. home financing, interest rate, house prices, stock

Coefficient	HFC	T-ratio	HFI	T-ratio
ecm (−1)	−0.428	−4.8453***	−0.4389	−2.4875**
R^2	0.82755		0.95774	
Durbin–Watson	2.3069		2.6838	
Notes: ***Significant at 1% level; **significant at 5% level				

Table VII.
ECM coefficient

Plot of Cumulative Sum of Recursive Residuals

Plot of Cumulative Sum of Squares of Recursive Residuals

prices and GDP. The resulting IRFs for both cases, however, are similar to the IRF of the first ordering set and thus not presented here.

4.4 Results of forecast error variance decomposition
To gauge the relative strength of each macroeconomic shock in affecting both conventional and Islamic home financing for short-run analysis, the FEVD analysis is performed on the two sets of Cholesky ordering:

(1) home financing, interest rate, house prices, stock prices and GDP; and

(2) GDP, house prices, stock prices, home financing and interest rate.

Similar to IRF analysis, the test for more than one ordering is to increase the robustness of the FEVD analysis. The variance decompositions for orderings on both HFI and HFC are presented in Tables VIII and IX, respectively.

For the model HFC, the FEVD for both sets of ordering presents similar results where KLCI accounts to 34-41 per cent of shocks to HFC at 10-quarter horizon. This means that KLCI is one of the most significant macroeconomic shocks in explaining the fluctuations in home financing provided by conventional banks. The second most important variable that contributes to short-run shocks in HFC is the GDP, contributing around 10-14 per cent of the forecast error variances in HFC. The variables HPI and OPR explain around 5-7 per cent of the forecast error variances in HFC. This result suggests that over the 10-quarter horizon, the effects of house price and interest rates movements are relatively insignificant to affect conventional home financing.

The FEVD for Islamic home financing produces different results where HPI contributes the most percentage, i.e. 25-35 per cent of the forecast error variances in HFI. As highlighted earlier, the amount of financing offered by Islamic banks, especially *murabahah*, is more tied to the actual value of the property. Also, GDP shocks contribute to only 7-15 per cent of forecast error variances in HFI. This finding also suggests that for households, in the model of both HFC and HFI, movements in GDP affect households' decision to borrow in the short run. Moreover, it is found that KLSI contributes to only 4-13 per cent of forecast error variances in HFI, suggesting performance of *Shariah*-compliant stocks affects households' decision to borrow in the short run. Finally, OPR explains 2-6 per cent of the forecast error
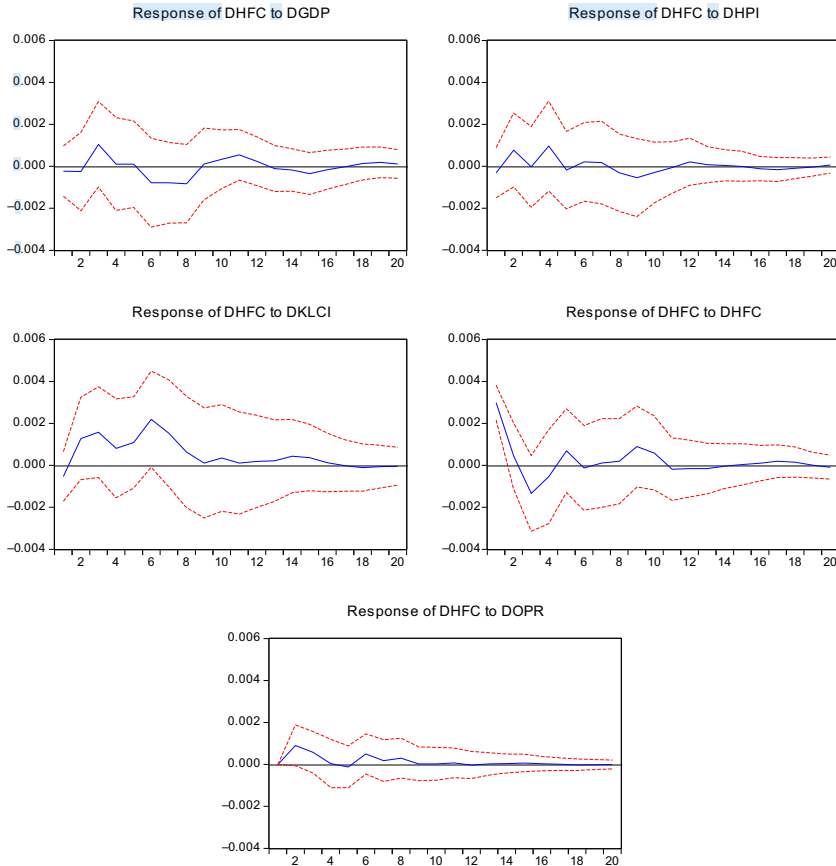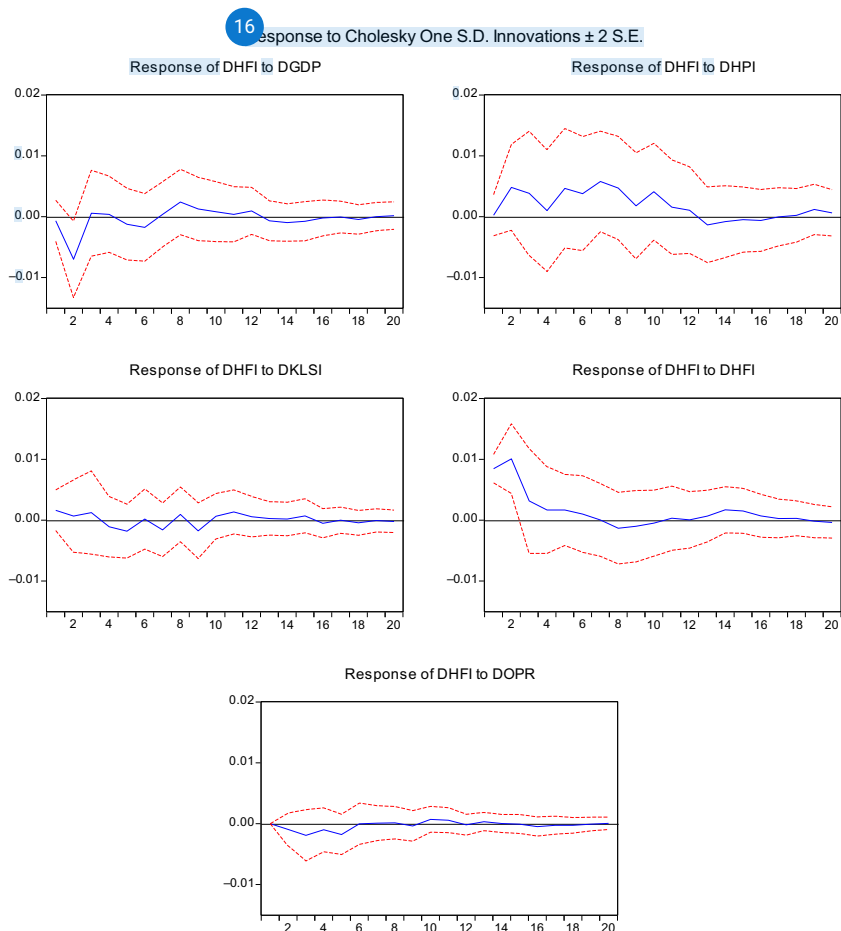
Figure 3.
Impulse responses of home financing provided by conventional banks to macroeconomic variables

variances in HFI. Although consistent with the results for HFC, the immediate effect of movements in OPR has smaller effects on HFI in the short run (2-7 per cent) over the 10-quarter horizon (Tables X and IX).

The following section evaluates the results of this study in line with the hypotheses formulated in Section 3. Table XII shows the summary of results based on the long-run analysis of the ARDL coefficient estimates.

Based on Table XIII, we can deduce that in the long run, while HFC is more correlated to OPR and KLCI, the HFI offered by Islamic banks is more linked to real sectors of the economy such as HPI and GDP. However, both HFC and HFI are significantly correlated with interest rates in the long run, which further indicate their susceptibilities to economic vulnerabilities attributed to interest rate fluctuations. In this regard, finding an alternative to interest rates for pricing home loans which is more linked to value of the property and real economy would potentially enhance the stability and sustainability of home financing offered by both conventional and Islamic banking sectors. Because interest plays a

Response to Cholesky One S.D. Innovations ± 2 S.E.

Figure 4.
Impulse responses of
home financing
provided by Islamic
banks to
macroeconomic
variables

Period	S.E.	DHFC	DOPR	DHPI	DKLCI	DGDP
1	0.003059	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.003560	74.06147	2.013296	2.192002	18.64242	3.090815
3	0.004288	65.92896	2.193317	1.917913	25.74079	4.219020
4	0.004503	62.73118	2.194153	5.713864	24.95302	4.407784
5	0.004692	58.92828	4.240015	5.692133	26.91807	4.221501
6	0.005269	47.50150	3.984204	4.660685	34.38490	9.468709
7	0.005547	42.88714	4.025441	4.309708	35.85489	12.92282
8	0.005665	41.22525	3.937220	4.828762	35.49174	14.51703
9	0.005763	42.27968	4.214741	4.844584	34.51547	14.14553
10	0.005820	42.22904	4.502263	4.754735	34.41174	14.10223

Note: Cholesky Ordering: DHFC DOPR DHPI DKLCI DGDP

Table VIII.
Forecast error
variance
decomposition of
home financing
provided by
conventional banks
(ordering 1)

significant role in pricing of home loans, the potential of an alternative such as rental rate is therefore timely and worth the effort to investigate further.

4.5 Granger causality
We extend our analysis by examining the pair-wise correlation between the variables by using granger causality test. Only significant results are reported and presented in Table XIV below.

The above output of Granger Causality test exhibits causality relationship running from one variable to the other. The statistical relationships among the variables according to Granger Causality test are presented as follows:

(1) Islamic Home Financing

- HFI significantly influences GDP as denoted by the value of probability 0.004 and can be concluded that there is unidirectional relationship running from HFI to GDP;

- HFI significantly influences HPI as denoted by the value of probability 0.0319 and thus can be concluded as having a unidirectional relationship running from HFI to HPI; and

- HFI significantly influences KLSI and at the same time being influenced by KLSI as denoted by the values of probability 0.0381 and 0.0081, respectively. We thus conclude that there is a bi-directional causality between these two variables.

Period	S.E.	DGDP	DHPI	DKLCI	DHFC	DOPR
1	0.009585	0.562258	1.018958	2.964609	95.45417	0.000000
2	0.015095	0.905944	5.452744	15.11587	72.08439	6.441047
3	0.017259	6.568517	3.760999	24.01903	59.40056	6.250892
4	0.018613	6.011051	7.985524	25.01739	55.30944	5.676594
5	0.020037	5.582902	7.503186	28.47241	53.14581	5.295697
6	0.020441	6.642002	6.112284	39.95498	42.19930	5.091430
7	0.020596	8.009142	5.617330	43.57011	38.10523	4.698191
8	0.021026	9.842160	5.687208	43.02996	36.66164	4.779028
9	0.021152	9.546974	6.384352	41.61459	37.83441	4.619675
10	0.021346	9.691108	6.515654	41.16699	38.09494	4.531301

Table IX.
Forecast error variance decomposition of home financing provided by conventional banks (ordering 2)

Note: Cholesky Ordering: DGDP DHPI DKLCI DHFC DOPR

Period	S.E.	DHFI	DOPR	DHPI	DKLSI	DGDP
1	0.008642	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.015805	75.44992	1.914814	1.323758	12.27194	9.039567
3	0.016728	71.38902	1.730403	7.491825	11.31808	8.070680
4	0.016910	70.56192	1.770792	7.640328	11.62584	8.401118
5	0.017844	64.07840	2.749875	10.96049	14.64359	7.567644
6	0.018352	61.03494	3.340684	12.49987	14.62686	8.497646
7	0.019309	55.13747	5.972815	17.27683	13.92305	7.689837
8	0.020082	51.33798	5.877399	22.45046	13.22381	7.110350
9	0.020303	50.68219	6.168266	22.64853	13.07004	7.430982
10	0.020754	48.53186	6.560272	25.00128	12.57394	7.332655

Table X.
Forecast error variance decomposition of home financing provided by Islamic banks (ordering 1)

Note: Cholesky Ordering: DHFI DOPR DHPI DKLSI DGDP

(2) Conventional Home Financing

- HFC significantly influences GDP as denoted by the value of probability 0.0152 and can be concluded that there is unidirectional relationship running from HFC to GDP;
- HFC significantly influences HPI as denoted by the value of probability 0.0550 and thus can be concluded as having a unidirectional relationship running from HFC to HPI;
- HFC significantly influences KLCI as denoted by the value of probability 0.0102 and thus can be concluded as having a unidirectional relationship running from HFC to KLCI; and
- HFC significantly influences OPR as denoted by the value of probability 0.0962 and thus can be concluded as having a unidirectional relationship running from HFC to OPR.

As evident in Table XIV, for pair-wise Granger causality analysis, it is interesting to note that Islamic Home Financing is significantly linked (at 1 per cent significance level) to the real sectors and activities of the economy like GDP, HPI and KLSI and not linked to interest rates in the short run. Conversely, conventional home financing is linked to GDP, HPI and KLCI to a smaller extent (only at 5 and 10 per cent significance levels) and at the same time

Period	S.E.	DGDP	DHPI	DKLSI	DHFI	DOPR
1	0.008234	0.629636	0.068602	3.507517	95.79424	0.000000
2	0.012328	19.87474	9.236924	1.219474	69.29084	0.378017
3	0.013517	17.84983	13.46267	1.640834	65.37381	1.672855
4	0.014976	17.51826	13.51217	2.026464	64.93815	2.004954
5	0.016724	16.22534	18.91430	2.866620	59.18326	2.810476
6	0.017069	16.27769	22.10473	2.719723	56.24054	2.657316
7	0.017516	14.73773	28.90100	3.159532	50.80005	2.401683
8	0.018536	15.04045	32.17677	3.142559	47.41554	2.224683
9	0.019070	15.09099	32.22816	3.831376	46.63493	2.214547
10	0.019520	14.58663	34.72386	3.762467	44.69299	2.234047

Note: Cholesky Ordering: DGDP DHPI DKLSI DHFI DOPR

Table XI.
Forecast error variance decomposition of home financing provided by Islamic banks (ordering 2)

Hypotheses	Long-run analysis		Short-run analysis	
	HFC model	HFI model	HFC model	HFI model
H1. There is no significant relationship between GDP and home financing	Fail to reject H1	Reject H1	Fail to reject H1	Fail to reject H1
H2. There is no significant relationship between house prices and home financing	Fail to reject H2	Reject H2	Fail to reject H2	Reject H2
H3. There is no significant relationship between stock prices and home financing	Reject H3	Fail to reject H3	Fail to reject H3	Fail to reject H3
H4. There is no significant relationship between interest rate and home financing	Reject H4	Reject H4	Fail to reject H4	Fail to reject H4

Table XII.
Hypotheses and findings of the study

has a unidirectional causality running from HFC to OPR. These findings further substantiate our contention that amount of financing offered by Islamic banks is less susceptible to interest rate fluctuations at least in the short run. This could be because of *murabahah*-based transaction that relies more on the value of the property, i.e. the house price, and other real economic indicators such as GDP and KLSI.

The above findings further underscore our view that Islamic home financing does not have to depend on interest rates as benchmark. It is therefore worth exploring an alternative pricing, namely, rental rate, which truly captures the physical attributes of the property and at the same time is more resilient and less susceptible to economic vulnerabilities.

5. Conclusion and recommendation

The 2007-2008 financial crisis has attracted interests in examining the impact of macroeconomic shocks on home financing. This study in particular analyzes the dynamic relationship between selected macroeconomic variable shocks (i.e. GDP, house prices, stock prices and interest rate) and home financing provided by conventional (HFC) and Islamic banks (HFI). By using ARDL model approach, IRF and FEVD, this study suggests that the dynamic relationship of macroeconomic variables and home financing provided by Islamic banks is different from that of conventional banks. Both in the long run and short run, home financing provided by Islamic banks is more linked to real sector economy as compared to home financing provided by conventional banks. Nevertheless, interest rate has a significant effect on both conventional and Islamic home financing in the long run. Therefore, to reduce banking fragility and susceptibility to macroeconomic shocks, Islamic banks need to explore alternatives other than interest rates in pricing their home financing products.

The Granger causality test suggests that although GDP, KLCI/KLSI and HPI are found to be statistically significant to have causal relationship with HFC and HFI, HFC is

| Variables | Long run (significance) | | Short run (significance) | |
	HFC	HFI	HFC	HFI
GDP	X	/**	/	/
OPR (interest rates)	/***	/*	X	X
HPI	X	/***	X	/
KLCI/KLSI	/**	X	/	/

Table XIII.
Summary of results

Notes: X indicates non-significance;/indicates significance in the short run in terms of FEVD; ***significant at 1% level; **significant at 5% level; *significant at 10% level

| | Islamic home financing | | | Conventional home financing | | |
Variables	Significance (*F*-stats)	Causality	Variables	Significance (*F*-stats)	Causality
HFI → GDP	9.72621***	Unidirectional	HFC → GDP	4.43272*	Unidirectional
HFI → HPI	3.58777***	Unidirectional	HFC → HPI	2.99793**	Unidirectional
HFI ←→ KLSI	3.39014**	Bidirectional	HFC → KLCI	4.91230*	Unidirectional
	5.20544***				
HFI not linked to OPR	–	–	HFC → OPR	2.41921*	Unidirectional

Table XIV.
Granger causality

Notes: ***Significant at 1% level; **significant at 5% level; *significant at 10% level

additionally granger caused by the OPR and therefore making it more volatile in the short run. Accordingly, in order for Islamic banks to be differentiated from conventional banks, a different basis of profit rate, which is independent of interest rate, needs to be developed for Islamic banks. As proposed by scholars, a new benchmark like rental rate which reflects the true value of the property and at the same time captures the macroeconomic conditions, which will enable Islamic banks to be less prone to interest rate fluctuations, is very much needed in the industry (Meera and Abdul Razak, 2005).

An alternative such as rental index or rental rate may be used by Islamic banks in the pricing of home financing. Its features such as reflecting true values of the property and less susceptible to macroeconomic fluctuations as deemed by scholars may mitigate fragility of banks in Malaysia.

This study has focused on analyzing the macroeconomic shocks on home financing. However, this study does not assess the impact of financial deregulation and enhanced information technology on the amount of financing offered by both conventional and Islamic banks. In addition, it is not within the ambit of this present study to examine the effects of agency costs and information asymmetry (Fitzpatrick and McQuinn, 2007). It is recommended that these factors are incorporated in future studies.

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