



ISLAMIC HOME FINANCING AND THE REAL SECTORS IN MALAYSIA: AN ARDL BOUND TESTING APPROACH TO COINTEGRATION

R.M. Yusof^{a,b} and F.H. Usman^{a,c}

^a *Islamic Business School, College of Business, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia.*
(Email: ^b rosylin@uum.edu.my; ^c farrellusman@gmail.com)

ABSTRACT

This study examines the dynamic relationship between macroeconomic variables (i.e., gross domestic product, house prices, stock prices, and interest rate) and home financing provided by Islamic banks in Malaysia. Using quarterly data from 2007 to 2014, this study employs autoregressive distributed lag (ARDL) bound testing cointegration approach, impulse response function (IRF), and forecast error variance decomposition (FEVD) to analyze the long-run and short-run relationships between selected macroeconomic variables and amount of Islamic home financing. This study finds that macroeconomic variables have distinct long-run and short-run influence on Islamic home financing. Our findings reveal that policy intervention to stimulate or dampen home financing provided by Islamic banks, in the long run, can focus on GDP, house prices, and monetary policy. This further underscores the link between the real sector of the economy and bank lending by Islamic banks. In addition, this study documents evidence that Islamic home financing in Malaysia, at least in the short run, is not dependent on interest rate and hence, calls for a potential alternative rate, possibly rental rate, that can be used as a benchmark rather than the current conventional interest rate. To a certain extent, the findings suggest that Islamic banks are non interest based and have managed to live up to their ideals in achieving the objectives of Sharī'ah (maqāṣid al-Sharī'ah) by promoting real sectors to increase Islamic home financing. This study is among the very few studies that empirically examine the nexus between Islamic home financing and real sector of the economy.

JEL Classification: R31, E210, G210

Keywords: Islamic banks, Home financing, Real sector, Malaysia, ARDL

1. INTRODUCTION

The recent global financial crisis has triggered a new interest in the study of credit fluctuations in the economies of the world. Schularick and Taylor (2009) argue that credit fluctuations could have critical roles in amplifying, transmitting, and creating shocks both in normal times and, particularly, when there is financial distress. Home financing is crucial in analyzing fluctuations in credit. Some researches have linked 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, as a precursor to a financial crisis (Schularick and Taylor, 2009). Although not all credit booms result in financial crises (Mendoza and Terrones, 2008), policymakers including central banks are paying greater attention on maintaining ideal levels of credit considering the trends and movements in the economy.

For banks, home financing is an important line of business. Household lending has increased over time and, in several countries, banks grant more loans to households than to firms (Beck, Büyükkarabacak, Rioja, and Valev, 2012). In Malaysia, home financing is a key source of funding for households. According to Bank Negara Malaysia (BNM) (2014), many Malaysians believe that owning or investing in properties is an important financial goal. As at December 2013, Malaysian households obtained around 80.9% of their total credit from the banking sector (BNM, 2014). Moreover, in the same year, purchase of residential properties amounted to 47.1% of total household debt from the banking system in Malaysia (BNM, 2014). Home financing in Malaysia also accounts for 28.1% of total banking system loans as at end 2013. As compared to the previous year, growth in bank lending for purchase of residential properties stands at 13.4%.

From the Islamic perspective, the legitimacy of home financing as a means of securing housing is rooted in the basic principle of realizing *maqāṣid al-Sharī'ah* (Ahmad, 2009; Ahmed, 2011). As Al-Ghazālī identifies, *maqāṣid al-Sharī'ah* which refers to the objectives of Islamic law consists of three categories: essentials (*ḍarūrīyah*), complementary requirements (*ḥājīyah*), and beautifications or embellishments (*taḥsīnīyah*). Essentials entail five basic elements which are indispensable in themselves for the survival of people. These are safeguarding of religion (*dīn*), human life (*nafs*), lineage (*nasl*), wealth (*māl*), and intellect (*'aql*). At the very least, having a home becomes a necessity to preserve and protect religion,

human life, children, wealth and intellect. The importance of meeting the need for shelter, together with food and clothing, is also well discussed in Maslow's (1954) Theory of Motivation. In practice nowadays however, it is difficult to obtain a house without resorting to home financing.

Islamic home financing as practiced by banks in Malaysia focuses more on two most common modes of financing namely *bai' bithaman ajil* (BBA) and the more recently offered which is *mushārah mutanāqīshah*. While BBA is generally defined as cost-plus sale transaction, *mushārah mutanāqīshah* (decreasing partnership) is generally an equity-based financing combined with rental (*ijārah*) (Meera and Abdul Razak, 2005; El-Gamal, 2006). The Islamic home financing is therefore, arguably, linked to the real sector of the economy since it is asset-backed and based on sale or equity transactions rather than just a borrowing contract. The fact that the Islamic home financing is asset backed according to some scholars makes it less speculative in nature and thus less susceptible to financial crises.

Against this backdrop, this study seeks to examine the macroeconomic determinants of Islamic home financing in order to establish the nexus between the two. With a dual banking system where the Islamic financial system is working in parallel with the conventional system, this study hopes to shed some light on the role of the real sector in determining Islamic home financing. Examining both the short run and long run dynamics between Islamic home financing and the macroeconomic variables enable greater understanding of the real sector role in promoting bank lending. Various lending policies and strategies may be designed or adopted by bankers and other industry practitioners in response to a favorable or unfavorable economic trend to ensure credit demand stability. Moreover, the policy ramifications of this research can be formulated to either stimulate or dampen home financing. By knowing the influence of macroeconomic factors on home financing, the general public, especially the households, will be able to make strategic decisions on their financing and investment activities.

The rest of the paper is organized as follows: Section 2 highlights the theoretical underpinnings and literature review. Section 3 discusses the data and methodology. Section 4 presents results and findings and Section 5 concludes.

2. THEORETICAL UNDERPINNINGS AND LITERATURE REVIEW

The study of macroeconomic determinants of credit has often been linked to the standard economic theory of wealth effects, financial accelerator and credit view. Wealth effect, as cited by Case, Quigley, and Shiller (2005), is generally defined as the causal effect of exogenous changes in wealth upon consumption behavior. It is commonly viewed that stock market wealth positively affects household behavior, especially consumption (Starr-McCluer, 1998; Poterba, 2000). On the other hand, Case, Quigley, and Shiller (2005) extended the discussion of wealth effect to the housing market. They argue that stock market wealth may not exactly explain the changes in household behavior in the real estate market. Households view residential property investment not in the same way as stock investments. The permanent nature of house investment, bequest motives, and certainty of investment are among the differentiating features between house and stock investments. They find that consumption is positively and significantly affected by variations in housing market wealth. However, declines in housing market wealth have no influence upon consumption.

In the presence of credit market frictions, Bernanke, Gertler, and Gilchrist (1999) find that financial accelerators play an important role in explaining why unexpected increase in asset prices raises borrowers' net worth which affects their creditworthiness to borrow from banks. Fitzpatrick and McQuinn (2007) argue that due to the collateralization of residential mortgages using the re-sale values of housing, the theory of financial accelerator could be applied to the housing market. Financial accelerator refers to the amplification of initial shocks caused by changes in credit market conditions (Bernanke, Gertler, and Gilchrist, 1994).

Credit view, on the other hand, explains that a change in monetary policy increases or decreases open-market interest rates and tends to affect the external finance premium in the same direction (Bernanke and Gertler, 1995). The impact of monetary policy on the borrowing cost and subsequently on real spending and real economic activity is magnified due to this added influence of monetary policy on external finance premium. Sustained declines in GDP and price level normally follow the unexpected contraction of monetary policy even though monetary policy usually has only transitory effects on interest rates. The initial impact of a monetary policy contraction is absorbed by final demand which falls relatively

quickly after a change in policy. Accordingly, investment in residential properties is foremost affected by the sharp decline in final demand.

The 2007-2008 global financial crisis has been directly linked to bank credit particularly to the subprime mortgage in the United States (Bianco, 2008; Crotty, 2009; Jickling, 2009; Schularick and Taylor, 2009; McKibbin and Stoeckel, 2010). It is argued that changes in macroeconomic variables have resulted to significant rise in home financing which led to credit booms and bust episodes during the financial crisis (Bianco, 2008; Crotty, 2009; Jickling, 2009; Schularick and Taylor, 2009; McKibbin and Stoeckel, 2010). At the very least, macroeconomic factors such as GDP, house prices, stock prices and interest rate, among others, are important determinants of credit booms (Borio and Lowe, 2002; Mendoza and Terrones, 2008; Schularick and Taylor, 2009). The available empirical studies using cross-country and country-specific analyses on the relationship between credit and macroeconomic variables have produced mixed results (Kim and Moreno, 1994; Calza, Gartner, and Sousa, 2001; Hofmann, 2004; Gerlach and Peng, 2005; Ibrahim, 2006; Fitzpatrick and McQuinn, 2007; Brissimis and Vlassopoulos, 2009). Moreover, studies on emerging countries and countries with dual banking system have not been widely conducted.

According to BNM (2014), credit expansion in general improves financial deepening in the market and induces investment and consumption activities essential for growth. However, credit expansion that exceeds economic fundamentals and output potential can pose risks that can destabilize the economy and financial system. Despite its overarching importance, the dynamic relationship of home financing and macroeconomic factors has not been widely studied separately. When investigating the relationship of credit and macroeconomic variables, most researches have used larger credit aggregates such as total bank loans to the private sectors which may include personal credit, car financing, and other credit to domestic private non-financial sector (Kim and Moreno, 1994; Calza, Gartner, and Sousa, 2001; Hofmann, 2004; Gerlach and Peng, 2005; Ibrahim, 2006; Fitzpatrick and McQuinn, 2007; Schularick and Taylor, 2009). As compared to larger credit aggregates, home financing is likely to exhibit different short- and long-run dynamics given the original maturity is substantially longer than for other consumer loans and is normally collateralized (Fitzpatrick and McQuinn, 2007). Moreover, past researches have only focused on conventional banks. Primarily

due to the prohibition of interest and asset-based structure, the dynamic relationship of macroeconomic variables and home financing provided by Islamic banks is expected to be different from the conventional banks. Therefore this study is aimed at filling this gap by analyzing the dynamic relationship of macroeconomic variables and home financing provided by Islamic banks. Specifically, we seek to answer the following questions: What are the long-run and short-run relationships between macroeconomic variables (i.e. gross domestic product (GDP), house prices, stock prices, and interest rate) and home financing provided by Islamic banks? What macroeconomic variables strongly influence home financing provided by Islamic banks in the long run and in the short run?

In the empirical literature, credit aggregates are commonly assumed primarily to be demand determined (Bernanke and Blinder, 1988; Fase, 1995; Calza, Gartner, and Sousa, 2001), depending positively on economic activity and negatively on costs of financing. The critical role that credit plays in ensuring financial stability has led many researches to analyze the determinants of credit. They find that GDP, interest rates, house prices and stock prices are significant determinants of the total amount of financing (Kim and Moreno, 1994; Calza, Gartner, and Sousa, 2001; Hofmann, 2004; Gerlach and Peng, 2005; Ibrahim, 2006; Fitzpatrick and McQuinn, 2007; Brissimis and Vlassopoulos, 2009). The aspect of integrating all these variables in a single model has not been widely investigated although integrating a measure of real aggregate activity, lending rates, and asset prices is helpful in obtaining better estimates of the dynamic relationship between the economy and credit. More so, a sectoral breakdown of total credit such as financing for purchase of residential properties of households would allow for a more refined modeling of the behavior of credit demand (Calza, Gartner, and Sousa, 2001; Fitzpatrick and McQuinn, 2007).

There appears to be no clear agreement in the literature on how real economic activity, measured by GDP, influences the demand of credit of households (Calza, Gartner, and Sousa, 2001). The first view is that the consumption and investment demand of households is positively affected by economic conditions, which reflects the state of economic activity. As a result, it can be expected that economic activity may have a positive effect on demand for credit. The contrasting view is that GDP may have a negative relationship with credit demand since an increase in current productivity, which causes a rise in output and profits, may

encourage households to take advantage of more income in expansionary phases to cut down their debt levels (Bernanke and Gertler, 1995). In addition, a negative relationship between GDP and credit can also be plausible in the sense that, when economic activity slows down and income declines, household demand for credit increases to cushion off the impact of lower income and profits. The problem arises when there is a rise in credit while the economic activity is declining. Naturally, in this case, the ability of households to pay the periodic instalments of their loans is impaired, increasing the likelihood of bank default. High rates of mortgage default, together with falling house prices, have worsened the global financial crisis triggered and appear to be the characteristics of the recent financial crisis (Crotty, 2009).

Studying the long-run relationship of real loans, GDP, and interest rates in the euro area from 1980 to 1999, Calza, Gartner, and Sousa (2001) find that GDP has long-run positive relationship with real loans. Hofmann (2004) obtains the same findings while studying the relationship of aggregate bank credit, aggregate economic activity, interest rates and aggregate property prices in 16 industrialized countries from 1980 to 1998. Gerlach and Peng (2005) as well as Brissimis and Vlassopoulos (2009) who conducted their study in Hong Kong using data from 1982 to 2001 and Greece using data from 1993 to 2005, respectively, have found the same long-run positive relationship between GDP and credit. Meanwhile, studies that employed impulse response function analysis to reveal the short-run dynamics of GDP and credit provide mixed results. For instance, Kim and Moreno (1994), who studied credit fluctuations in Japan from 1970 to 1993, find that GDP has a negative impact on credit. On the other hand, Ibrahim (2006), who carried out the impulse response function (IRF) analysis in Malaysia using data from 1978 to 1998, finds a positive relationship between GDP and bank loans.

Prevailing trends of residential house prices are commonly measured using a house price index (HPI). House price indices are normally estimated for a geographic area not larger than country or metropolitan area since housing markets are geographically localized (Case, Pollakowski, and Wachter, 1991). Following financial crises, the relationship of house prices and credit has been extensively studied. Problems may exist if there is a rapid increase in the prices of real property until unsustainable levels are reached resulting in housing bubbles (Bianco, 2008; Jickling, 2009; Schularick and Taylor, 2009; McKibbin and Stoeckel, 2010). Fitzpatrick and

McQuinn (2007) investigated the relationship between domestic bank credit and house prices in Ireland. They found a mutually reinforcing long-run relationship between credit and house prices. However, they also found that house prices influence credit less than credit influences house prices. This is somewhat contrasting to the findings of other studies. Gerlach and Peng (2005), for example, find that in Hong Kong bank lending adjusts to house prices, rather than the other way around. Using error-correction models, they show that bank lending is influenced by house prices, but that bank lending does not seem to affect property prices. The study of Brissimis and Vlassopoulos (2009) on Greece also reports a positive long-run relationship between bank lending and housing prices. Using cointegration test, they further argue that housing prices do not adjust to disequilibria which means that in the long run mortgage lending does not affect housing prices. However, in the short-run, they find evidence of a contemporaneous bi-directional dependence. Using a cross-country perspective, Hofmann (2004) finds long-run positive relationship between credit and property prices in 14 out of 16 countries. He argues that innovations to property prices which possibly reflect changing beliefs about future economic conditions or speculation in the property market may result in significant and persistent cycles in bank lending.

Stock price indices are normally grouped based on some screening methodologies. With the advent of Islamic banking, Sharī'ah-based screening methodologies are now being applied. Sharī'ah screening standards are intended (1) to ensure that the counterparty selling the stocks is not involved in any activities non-compliant with Sharī'ah, and (2) to validate that (a) interest-bearing debt does not make a contribution significantly to the financing of the counterparty, (b) the counterparty generates revenue from illiquid assets, and (c) interest-bearing securities are not mainly used in the cash investments (Khan, 2012). Stock prices may positively influence credit in two ways. First, stock price fluctuations may influence loan demand by reflecting changes in future economic activity. 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 may influence the supply of loans by affecting the capital position of banks. Depending on their equity exposure, the banks may be keen to lend more when stock prices are rising, and conversely, to provide fewer loans when stock prices are falling, since the bank can use capital gains on stocks to mitigate the effects

of adverse shocks to assets. On the other hand, stocks and real estate may be regarded as substitute investments for households. Future expectations of risks and returns on stocks may affect the demand for housing loans. Stock price increases may attract more households to invest in equities over real estate.

Borio and Lowe (2002) as well as Schularick and Taylor (2009) argue that if there is asset price boom (i.e., rapid increase in property and stock prices) and increase in bank lending, the probability of an episode of financial instability risk could be higher. Investigating the contributions of stock price movements to credit fluctuations, Kim and Moreno (1994) find that in Japan the response of loans to shocks in the stock price is positive. This is supported by Ibrahim (2006) who finds that bank loans positively react to the rise in stock prices; however, banks loans appear to have no influence over stock prices.

Interest rate is normally referred in the literature as an important determinant of credit primarily because it measures the cost of financing. In explaining the effect of interest rate on home financing, this study uses overnight policy rate (OPR), which is the used by the BNM as the target rate for the day-to-day liquidity operations and to signal monetary policy stance.

It is critical to test the influence of interest rate on home financing in a dual banking system. As it is prohibited for Islamic banks to engage in interest-related activities, it is generally expected that interest rate does not influence the financing activities of Islamic banks. On the other hand, in general, past researchers find a negative relationship between interest rate and home financing provided by conventional banks. Typically an increase in interest rates makes the loans more expensive, thus, demand for loans is reduced. On the other hand, a low interest rate would induce borrowing. Many believed that the 2007-2008 financial crisis is also partly due to the historically low interest rates set by the US Federal Reserve in 2001 to 2004 which attracted many people to take mortgages to buy houses, hence raising house prices (Bianco, 2008; Crotty, 2009; Jickling, 2009; McKibbin and Stoeckel, 2010).

Hofmann (2004) finds a negative and significant relationship of interest rate and credit in nine out of the sixteen countries under investigation. Interestingly, Fitzpatrick and McQuinn (2007) find a long-run positive relationship between interest rate and credit. They argue this may be due to the relatively high correlation of mortgage rates with other market interest rates such as deposit rates. Similarly,

Ibrahim (2006) finds positive relationship of interest rate and credit in the short-run.

Meanwhile, Kassim, Majid, and Yusof (2009) studied the impact of monetary policy shocks on conventional and Islamic banks in Malaysia for the period January 1999 to December 2006. Using impulse response function and variance decomposition analysis based on VAR, they find that contrary to general expectations, Islamic banks' loans and deposits are relatively more sensitive to changes in monetary policy measured by the overnight policy rate set by BNM.

3. DATA AND METHODOLOGY

For robustness testing of the relationship between macroeconomic variables and credit growth, this study uses the amount of home financing rather than larger credit aggregates (Gerlach and Peng, 2005; Fitzpatrick and McQuinn, 2007). This study covers the period of 2007:Q1 to 2014:Q2 where it limits itself from analyzing credit booms and bust arising from the recent financial crisis. This is primarily because Malaysia, in general, has weathered out the effects of the 2007-2008 financial crisis (Abidin and Rasiah, 2009; Khoo and Mah-Hui, 2010; Lim and Goh, 2012). The measurements of variables are summarized in Table 3.1.

TABLE 3.1
Measurements of Variables (Period: 1Q 2007 to 2Q 2014)

Variables	Measurement	Sources
Home financing by Islamic banks	Amount of home financing provided by Islamic banks (HFI)	BNM Monthly Statistical Bulletin
Gross domestic product	Gross domestic product, 2005 constant prices, seasonally adjusted (GDP)	Oxford Economics
House prices	Malaysian house price index (HPI)	Department of Statistics, Malaysia
Sharī' ah-compliant stock prices	FTSE Bursa Malaysia EMAS Sharī' ah - Price Index (KLSI)	FTSE
Interest rate	BNM Overnight Policy Rate - Middle Rate (OPR)	BNM Monthly Statistical Bulletin

The time series analysis involves the standard procedure of testing the stationarity of the variables of the models using unit root test and estimation of long-run relationship by means of cointegration test. In line with the research objectives, this study also performs IRF and forecast error variance decomposition (FEVD) based on the vector autoregression (VAR) model to explain how each shock affects the dynamic path of all of system variables in the short run. Table 3.2 summarizes the time series analysis techniques employed in this study corresponding to the research objectives.

TABLE 3.2
Research Objectives and Time Series Analysis Techniques

Research Objectives	Time Series Analysis Techniques
To test whether there is long-run cointegration between macroeconomic variables (i.e., gross domestic product, house prices, stock prices, and interest rate) and Islamic home financing.	ARDL (Bound Testing Cointegration Approach)
To test whether there is short-run relationship between macroeconomic variables (i.e., gross domestic product, house prices, stock prices, and interest rate) and home financing provided by Islamic banks	Impulse response functions
To measure the influence of each macroeconomic variable (i.e., gross domestic product, house prices, stock prices, and interest rate) on Islamic home in the long run and in the short run.	a. ARDL (long-run coefficient estimates) b. Forecast error variance decomposition (short-run)

Consistent with Kim and Moreno (1994) by integrating real output, price level, and interest rate into the analysis of credit, the ARDL model used in this study can be expressed as follows:

$$(1) \quad HFI_t = \alpha_0 + \alpha_1 GDP_t + \alpha_2 HPI_t + \alpha_3 KLSI_t + \alpha_4 OPR_t + e_t$$

where HFI refers to home financing provided by Islamic banks, respectively, while the macroeconomic variables are real GDP or

gross domestic product, HPI refers to Malaysian House Price Index, KLSI refers to Islamic stock price index, OPR refers to overnight policy rate set by Bank Negara Malaysia, and e refers to error term. All series, except for OPR, are transformed into natural logarithms.

3.1 UNIT ROOT TEST

In time series, stationarity of variables is important for estimation. Applying least squares regressions on non-stationary variables can give incorrect parameter estimates of the relationships between variables. Testing using ordinary least squares (OLS) may result in spurious regression in which the results show that the model is a good fit and there is a statistically significant relationship between variables where none actually exists. For macroeconomic variables, it is very common to find non-stationary series. Unit root test is used to verify whether a variable is stationary at level, $I(0)$ or stationary at first differencing, $I(1)$. If unit root exists, it suggests that the variable is not stationary. The process of differencing will reduce it to stationarity.

To test for the presence of unit root in variables, this study applies the augmented Dickey-Fuller (ADF) test. The regression of ADF test allows lags of the first differences in order to solve the problem of serial correlation.

3.2 ARDL BOUND TESTING COINTEGRATION APPROACH (LONG-RUN ANALYSIS)

Several cointegration techniques allow empirical testing for the existence of long-run relationship among variables. The most common approaches are the two-steps residual-based procedure by Engle and Granger (1987), the system-based reduced rank regression approach from Johansen (1991), and autoregressive distributed lag (ARDL) model popularized by Pesaran, Shin, and Smith (1999). The first two approaches necessitate that the underlying variables are integrated of order $I(0)$ or $I(1)$. This unavoidably involves pre-testing which may introduce a degree of uncertainty which can affect analysis of long-run relationships. On the other hand, the third testing procedure can be used to reliably test hypotheses on coefficients when the variables are $I(0)$ or $I(1)$. Moreover, the ARDL model is applicable to studies involving small finite samples and it is robust against simultaneous equation bias and autocorrelation problems provided that the orders of the ARDL model are adequately chosen based on a priori knowledge or

estimated using a model selection process such as the Akaike Information Criterion (AIC) or Schwarz-Bayesian Criterion (SBC). Taking all these into consideration, the ARDL model is chosen as appropriate for this study.

The error-correction representation of the ARDL model of this study can be expressed as follows:

$$(2) \quad \Delta \ln HFI_t = a_0 + \sum_{j=1}^{k1} b_j \Delta \ln HFI_{t-j} + \sum_{j=0}^{k2} c_j \Delta \ln GDP_{t-j} + \sum_{j=0}^{k3} d_j \Delta \ln HPI_{t-j} + \sum_{j=0}^{k4} e_j \Delta \ln KLSI_{t-j} + \sum_{j=0}^{k5} f_j \Delta OPR_{t-j} + n_1 \ln HFI_{t-1} + n_2 \ln GDP_{t-1} + n_3 \ln HPI_{t-1} + n_4 \ln KLSI_{t-1} + n_5 OPR_{t-1} + \varepsilon_t$$

where *HFI* represents Islamic Home Financing, *GDP* is Gross Domestic Product, *KLSI* is Kuala Lumpur Sharī‘ah Index and *OPR* is the Overnight Policy Rate. The error-correction dynamics is represented by the terms with the summation signs, while the long-run relationship is represented by the second part. ε_t refers to the random error term.

The bound testing approach involves four stages. The first stage is to ascertain the presence of cointegration or long-run relationship among the variables based on estimating error correction models (ECM). Once cointegration is confirmed, the second stage is to estimate the long-run relationship between macroeconomic variables and home financing provided by Islamic banks using the selected ARDL model. The third stage is to estimate the associated ARDL ECM. Lastly, diagnostic and stability testing are performed to determine in the goodness of fit of the ARDL model.

ARDL bound testing approach is conducted using *F*-test, which checks the joint significance of the coefficients on the one period lagged levels of the variables (Narayan, 2005). *F*-test has a non-standard distribution which depends on (a) whether variables are *I*(0) or *I*(1), (b) number of regressors, (c) number of observations, and (d) whether the ARDL model has an intercept and/or a trend.

Narayan (2005) provides two sets of critical values of bound. The first set assumes that all the independent variables are *I*(1) and the other 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.

Diagnostic testing is used to check the serial correlation, functional form, normality, and heteroscedasticity related with the ARDL models. On the other hand, the structural stability tests are performed using cumulative sum of recursive residual (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ). The CUSUM and CUSUMSQ tests use the cumulative sum of recursive residuals based on the first set of observations and is updated recursively and plotted against the break points. The null hypothesis that all coefficients in the ECMs as in the ARDL models for HFI are stable and cannot be rejected if the plots of the CUSUM and CUSUMSQ statistics are established within the critical bounds of 5% significance level. Conversely, the null hypothesis of the stability of coefficients can be rejected if the lines are found to be crossed.

3.3 IMPULSE RESPONSE FUNCTION AND FORECAST ERROR VARIANCE DECOMPOSITION (SHORT-RUN ANALYSIS)

It is practically useful to ascertain the response of one variable to an impulse or shock in another variable in a system equation. IRF reveals the impulse response relationship between two variables in a higher dimensional system. If there is a significant reaction of one variable to an impulse in another variable, causal relationship from the latter variable to the former can be established.

IRF measures the dynamic marginal effects of each shock on all of the variables over a period of time. Forecast error variance decomposition (FEVD), on the other hand, examines how strong each of the shocks is as a component of the overall, unpredictable variance of each of the 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., gross domestic product, house prices, stock prices, and interest rate) on home financing provided by Islamic banks.

Vector autoregression (VAR) was introduced by Sims (1980) as a technique that could be used to characterize the joint dynamic behavior of a collection of variables. When using IRF and FEVD following the VAR model, it is important to highlight that shocks in VAR equations may be correlated contemporaneously. This happens when a shock in one variable works through the contemporaneous correlation with shocks in other variables. The problem of inadequate depiction of the responses of a variable to shocks in another variable occurs when isolated shocks to each variable cannot be determined because of contemporaneous correlation. To solve this identification problem, Sims' (1980) strategy of orthogonalizing the shocks using Cholesky decomposition is normally employed. Orthogonalizing the VAR's shocks is critical in order that the shocks tracked by IRFs are not correlated.

The ordering adopted for this study is similar to Hofmann (2004) which is as follows: real GDP, house prices, stock prices, Islamic 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 commonly the standard assumption in the monetary policy transmission literature. Moreover, it assumed 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 flexible such that it is permitted to respond within quarter to shocks to real GDP, property prices, stock prices and home financing. The chosen ordering also reflects the typical assumption that changes in interest rates are transmitted to the economy with a lag. Similar to Hofmann (2004), this study finds that the ordering reflects the existing business cycle and monetary policy perspectives.

For robustness check, this study also performed (1) generalized impulse response function and (2) IRF based on another Cholesky ordering of variables: Islamic home financing, interest rate, house prices, stock prices, and GDP. According to Koop, Pesaran, and Potter (1996) and Pesaran and Shin (1998), generalized impulse response function avoids the ordering problem inherent in the orthogonalized impulse responses. The historical patterns of correlations among different shocks in generalized impulse response function approach are fully incorporated, allowing the impulse responses to be unique and hence invariant to the orderings of the

variables. On the other hand, the theoretical justification of performing IRF on the second set of ordering is the other view that home financing is expected to have strongest response to its own shock, followed by the shocks on interest rate, house prices, stock prices, and GDP.

4. FINDINGS AND ANALYSIS

4.1 RESULTS OF UNIT ROOT TEST

We start our analysis by conducting a preliminary testing for stationarity. The null hypothesis is that unit root exists. Table 4.1 presents the unit root test results for variables HFI, GDP, HPI, KLSI, and OPR.

All the selected variables are found to be either integrated of order 0 or 1; hence this study justifies the use of ARDL model. Pesaran, Shin and Smith (1999) suggest that ARDL approach can reliably test hypotheses on coefficients in which the variables are integrated of order 0 or 1.

TABLE 4.1
Summary of Unit Root Test

Variables	Graph	At Level	At 1st Difference	Results at 10%
HFI	Trend and Intercept	-4.9354***	-2.4211	<i>I</i> (0)
GDP	Trend and Intercept	-2.6728	-4.1902**	<i>I</i> (1)
HPI	Trend and Intercept	-1.9527	-5.1696***	<i>I</i> (1)
KLSI	Trend and Intercept	-3.0266	-3.8256**	<i>I</i> (1)
OPR	Intercept	-2.1551	-4.0358***	<i>I</i> (1)

Note: ***, **, * significant at the 1%, 5% and 10% levels, respectively.

4.2 RESULTS OF ARDL MODEL APPROACH

The ARDL model approach specifies a maximum lag length to search over the parameter space. Using SBC for model selection, a maximum number of 3 lags was chosen on the basis that the data are quarterly in nature and in light of the limited number of observations. Table 4.2 shows the ARDL model selected by SBC and *F*-statistics for ARDL.

As evidenced in Table 4.2, the computed *F*-statistics for the model suggests that there are cointegrating relationships among the selected variables at the selected lag length. The findings suggest that

home financing provided by Islamic banks is significantly affected by macroeconomic variables. This is consistent with the findings of Ibrahim (2006) in which he finds cointegrating relationship between conventional credit and macroeconomic variables.

TABLE 4.2
Bound-testing Procedure Results

Cointegration hypotheses	<i>F</i> -statistics
$F(\text{HFI} \text{GDP, HPI, KLSI, OPR})$	9.1683***

Notes: *F*-statistics exceeds the ***1% critical values; the relevant critical values for the bounds test 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 1% significance level, 3.715-4.878 at the 5% significance level and 3.097-4.118 at the 10% significance level.

As evidenced in Table 4.3, the negative relationship of GDP and HFI suggests that when GDP increases (decreases), the demand for Islamic home financing decreases (increases). The findings are consistent with the observation by Bernanke and Gertler (1995) in times of expansionary phase and high income, households tend to improve their balance sheet by reducing their debt levels and use their internal sources of finance more in order to meet their consumption and investment needs. However, in times of economic contraction in which there is an overall decline in income, households' need for financing increases as less sources of funds are available. This is apparent in Figure 4.1 in which 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.

TABLE 4.3
Long-run ARDL model estimates

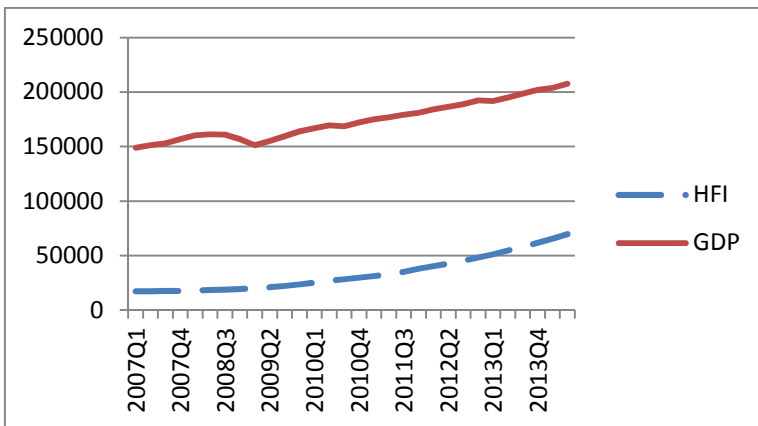
Regressors	HFI	T- ratio
GDP	-2.195**	-2.2249
HPI	1.3303***	5.2740
KLSI	-0.1363	-0.5975
OPR	12.6367*	2.0121
C	74.3028**	2.0121
T	0.0563***	4.0289

Note: ***, **, * significant at the 1%, 5% and 10% levels, respectively.

The positive relationship of HPI and HFI suggests that when house prices increase (decrease), the demand for Islamic home financing increases (decreases). This findings support the theory on financial accelerator and wealth effects on household behavior to consume and invest. When prices of residential property increases, households' net worth increases due to higher valuation in real property assets. Similar to conventional banks, real property assets used as collateral in debt-based financing modes is 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 seems to influence 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 HFI. 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). This means that when OPR increases (decreases), Islamic investment rates also increases (decreases). High investment rates will attract more investment funds from depositors, thus increasing the ability of Islamic banks to provide more home financing

FIGURE 4.1
GDP and HFI from 1Q 2007 to 2Q 2014 (in RM millions)



Source: BNM Monthly Statistical Bulletin.

The long-run ARDL model estimates for the macroeconomic determinants of home financing provided by Islamic banks can thus be summarized as follows:

1. Islamic banks seem to be affected by OPR at the 5% significance level. This is consistent with the findings of Kassim, Majid, and Yusof (2009) which argue that since the Islamic banking industry is still underdeveloped and has limited options to do business as compared to the conventional banking industry which has a deep and wide market and global linkages, Islamic banks bear greater impact of monetary policy.
2. The results on GDP being negatively significant to HFI suggests that home financing provided by Islamic banks are more linked to movements in real economic activity which affect households' decision to borrow.
3. HPI is positively significant to HFI can be likely explained by the predominant use of *murābaḥah* or cost-plus-mark-up credit sale contracts in Islamic home financing. Among other conditions, the actual original price of the house in *murābaḥah* home financing must be disclosed to make the contract valid (Ayub, 2007). Thus, house price significantly influences households' decision to obtain home financing. However, for conventional home financing, such a condition to disclose is not required. This is an important advantage of Islamic home financing, especially *murābaḥah* contracts. Since *murābaḥah* contract is a *trust*-based contract, full disclosure allows parties to decide with free will and confidence (Ayub, 2007). Moreover, this strengthens the notion that home financing provided by Islamic banks reflect market conditions.
4. The non-significant relationship between KLSI and HFI may be explained by the households' risk-averse appetite on equity investments. Nurhanani, Ahmad, and Mohd (2012) find that during the economic turn from 2007 to 2010, Islamic stock market index has higher volatility than conventional composite stock index.

The final step in estimating the ARDL model approach is to test the stability of the long-and short-run dynamics of the ARDL model. Based on Figures 4.2a and Figure 4.2b, the CUSUM and CUSUMSQ tests suggest no evidence of any significant structural instability.

FIGURE 4.2a
CUSUM and CUSUMSQ Tests

Plot of Cumulative Sum of Recursive Residuals

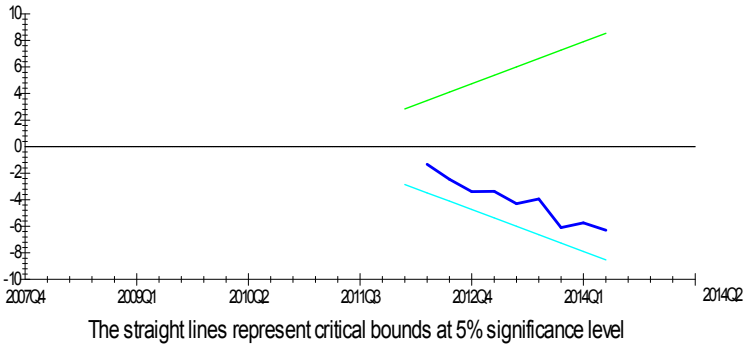
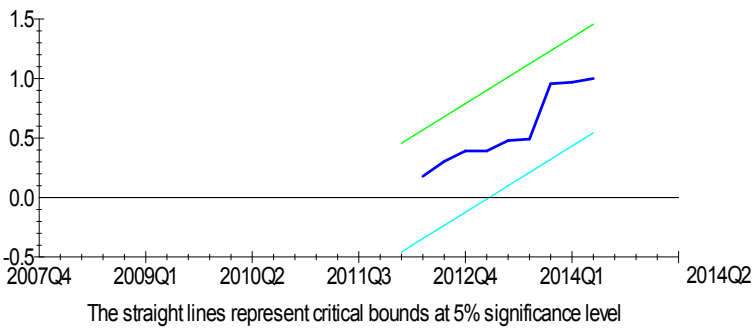


FIGURE 4.2b
CUSUM and CUSUMSQ Tests

Plot of Cumulative Sum of Squares of Recursive Residuals



4.3 RESULTS OF IMPULSE RESPONSE FUNCTIONS

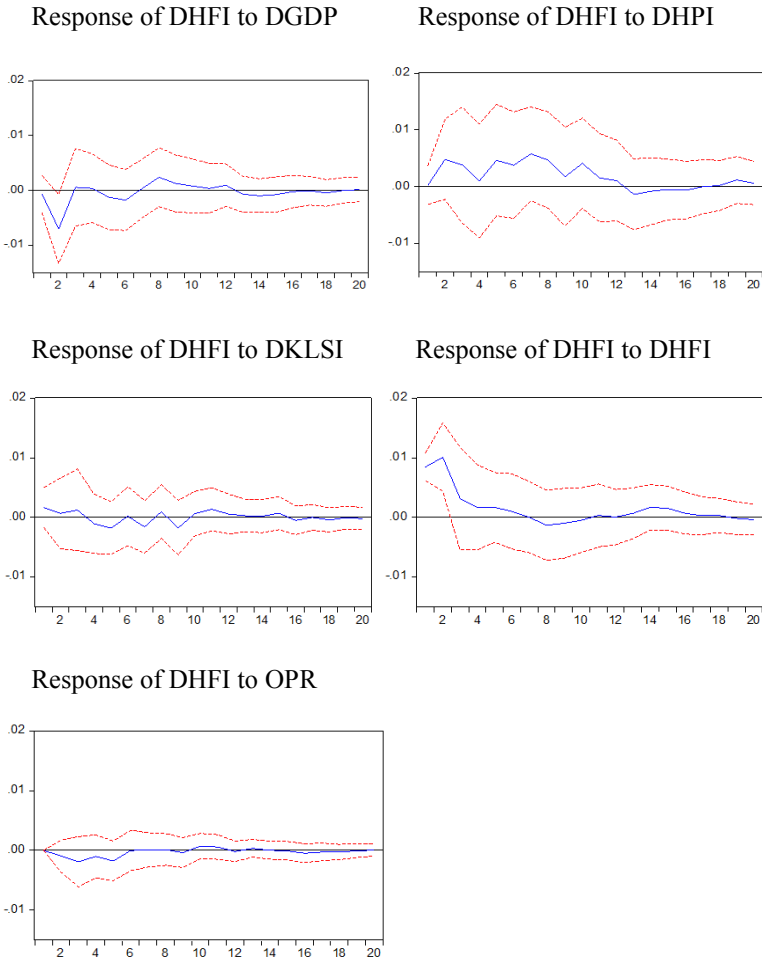
The study adopts the following order of variables to perform IRF analysis: GDP, house prices, stock prices, Islamic home financing, and interest rate. Figure 4.3 shows the impulse responses of HFI to shocks in the selected macroeconomic variables.

For robustness check, this study also performed generalized impulse response function and IRF based on another Cholesky

ordering of variables (i.e., Islamic home financing, interest rate, house prices, stock prices, and GDP). The resulting IRFs for both cases however, are qualitatively similar to the IRF of the first ordering set and thus no longer presented.

FIGURE 4.3
Impulse Responses of Home Financing Provided by Islamic Banks to
Macroeconomic Variables

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



4.4 RESULTS OF FORECAST ERROR VARIANCE DECOMPOSITION

FEVD analysis is performed on the two sets of Cholesky ordering: (1) Islamic home financing, interest rate, house prices, stock prices, and GDP and (2) GDP, house prices, stock prices, Islamic 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 results of FEVD for the ordering (1) and (2) are shown in Tables 4.4 and 4.5, respectively.

TABLE 4.4
Forecast Error Variance Decomposition (Ordering 1)

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
11	0.020866	48.08189	6.503988	25.32431	12.65567	7.434138
12	0.020921	47.82920	6.470793	25.64238	12.65099	7.406643
13	0.020991	47.62763	6.461262	25.95780	12.57147	7.381843
14	0.021099	47.81742	6.406986	25.95860	12.48089	7.336107
15	0.021184	48.04121	6.409550	25.82185	12.38285	7.344532
16	0.021218	47.96000	6.398134	25.82924	12.43404	7.378592
17	0.021222	47.95837	6.402433	25.82034	12.44100	7.377852
18	0.021237	47.90212	6.402103	25.78350	12.54470	7.367580
19	0.021271	47.75578	6.424406	25.93782	12.52325	7.358745
20	0.021285	47.73127	6.445394	25.96578	12.50846	7.349091

Cholesky Ordering: DHFI DOPR DHPI DKLSI DGDP

The FEVD results for both sets of ordering are also similar. Tables 4.4 and 4.5 show that in the short-run, other than the dominant effect of HFI's own shock, the variations in HPI explain

around 26% to 35% of forecast error variances in home financing provided by Islamic banks at the 20-quarter horizon. House prices are the most important determinant of home financing provided by Islamic banks in the short-run. GDP, on the other hand, contributes around 9% to 11% to the forecast error variances in HFI. This means that for households, movements in GDP affects households' decision to borrow in the short-run. Moreover, it is found that KLSI explain around 4% to 15% of forecast error variances in HFI.

TABLE 4.5
Forecast Error Variance Decomposition (Ordering 2)

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
11	0.019655	14.46088	34.89797	4.125777	44.23461	2.280760
12	0.019744	14.58331	34.96512	4.173372	44.00083	2.277370
13	0.019766	14.59667	35.14898	4.161432	43.80746	2.285462
14	0.019822	14.66828	34.94817	4.125766	43.99548	2.262308
15	0.019873	14.68148	34.72416	4.201696	44.14680	2.245855
16	0.019889	14.64523	34.69966	4.251801	44.11069	2.292620
17	0.019912	14.64134	34.68817	4.250432	44.11096	2.309087
18	0.019976	14.67167	34.64730	4.291112	44.06587	2.324054
19	0.020011	14.62534	34.84458	4.278417	43.93338	2.318277
20	0.020014	14.61136	34.88064	4.283555	43.90868	2.315761

Cholesky Ordering: DGDP DHPI DKLSI DHFI DOPR

This suggests that Sharī'ah-compliant stock index affect households' decision to borrow in the short-run. Finally, OPR explain 3% to 7% of the forecast error variances in HFI. From these

results, it can be inferred that the immediate effect of movements in overnight policy rate has the smallest effect on HFI in the short-run. We can thus infer that, at least in the short run, Islamic home financing is not interest based and hence calls for the possibility of an alternative rate such as rental rate to be an alternative rate to the current conventional interest rate.

Finally, the following section evaluates the results of this study in line with the formulated hypotheses. Table 4.6 shows that based on the long-run analysis of the ARDL coefficient estimates, H1, H2, and H4 are rejected. However, based on the short-run analysis using IRF, this study fails to reject all hypotheses. The findings of this study suggest that HFI is directly linked to the real sector of the economy. Moreover, at least in the short-run, HFI is not dependent on interest rate.

TABLE 4.6
Hypotheses and Findings of the Study

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

5. CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

The 2007-2008 financial crisis has spurred interest in determining the impact of macroeconomic variables and home financing. This

study in particular analyzes the dynamic relationship between selected macroeconomic variables (i.e. GDP, house prices, stock prices, and interest rate) and home financing provided by Islamic banks (HFI). Using the ARDL model approach, IRF, and FEVD, this study finds that macroeconomic variables have distinct long-run and short-run influence on Islamic home financing provided by Islamic banks. Both in the long-run and short-run, home financing provided by Islamic banks are more linked to real economic activity and house prices. More importantly, this study finds that overnight policy rate is significantly related to Islamic and conventional banks in the long-run but not in the short-run which means that Islamic home financing, at least in the short run is not dependent on the interest rates. These results can further infer the possibility of an alternative rate, that is, rental rate to be used as a benchmark rather than the current conventional interest rate.

5.2 POLICY IMPLICATIONS AND RECOMMENDATIONS

Home financing is important for various stakeholders including households and the banking industry. The financial instability experienced in the 2007-2008 financial crisis suggests that home financing can be affected by the soundness of the economy through various channels. Thus, this study has highlighted that the existence of a dual banking system in Malaysia offers a unique case of policy intervention on home financing provided by banks. Policy intervention to stimulate or dampen home financing provided by Islamic banks must focus on stabilizing house prices, GDP growth and implementing monetary policy. In addition, movements in macroeconomic variables are critical to analyze the fluctuations in home financing. However, this study does not account for the effect of financial deregulation and improved information technology. As emphasized in the beginning, agency costs and information asymmetry which are major credit frictions are assumed to affect the interplay of macroeconomic variables and home financing. However, as the impacts of financial deregulation and improved information technology take place incrementally over a number of years, it is difficult to pick up the macroeconomic impact empirically (Fitzpatrick and McQuinn, 2007). It is thus recommended that these factors are integrated for future study.

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