Rental rate as an alternative pricing for Islamic home financing

An empirical investigation on the UK Market

Rosylin Mohd Yusof
Islamic Business School, Universiti Utara Malaysia, Sintok, Malaysia
Mejda Bahlous
Department of Business, Rochester Institute of Technology, Dubai, UAE, and
Roszaini Haniffa
Herriot-Watt University, Edinburgh, UK

Received 19 October 2015
Revised 24 February 2016
Accepted 1 April 2016

Abstract

Purpose – This paper aims to contribute to the banking and housing market literature by proposing an alternative measure of rate of return for Islamic banks that is based on the rental rate of the property. This alternative Islamic mortgage pricing mechanism could be adopted by Islamic banks as a replacement for mortgage rates if it is found to be independent from any form of interest rates as required by Islamic law.

Design/methodology/approach – By investigating the short run and long run dynamics between rental price index (RPI) and the proposed Islamic Rental Rate (RR-I) and, three selected macroeconomic indicators in the UK via autoregressive distributed lag model, the authors examine the link between RPI, RR-I and the real economy.

Findings – The findings provide evidence that while RPI in the UK is significantly related to three leading macroeconomic variables, namely, gross domestic product (GDP), real effective exchange rate and interest rates measures, while RR-I is only impacted by changes in GDP. More importantly, the authors show that there is no short or long run dynamics between the rental rate and any form of interest rates.

Research limitations/implications – This paper did not attempt to investigate the impact of the physical attributes of the rental property to formalize the model describing the relationship between RPI and RR-I. Also, other macroeconomic factors like household income growth, risk, house value growth rate and taxation could be included in future models.

Practical implications – As Rental Rate is not linked to the macroeconomic determinants, it is therefore more stable, resilient and sustainable and, at the same time, making the financing less risky for both parties, as they are less susceptible to economic vulnerabilities.

Social implications – Some calculations incorporating the proposed RR-I can also be extended to the pricing of products based on other contracts such as Tawarruq, Bai Bithaman Ajil or even Murabahah for a fairer and just pricing to both the banks and customers.

JEL classification – C22, R210, E580, E1

The authors wish to express great appreciation to the International Research and Training Institute (IRTI), Islamic Development bank, Jeddah for funding this study. The authors acknowledge with thanks to those who have contributed towards successful completion of this project.

International Journal of Housing Markets and Analysis
Vol. 9 No. 4, 2016
pp. 601-626

1753-8270
DOI 10.1108/IJHMA-10-2015-0063

Originality/value – The results suggest that Islamic banks should consider incorporating the proposed rental rate (RR-I) when pricing their home financing products, as this will lead to less dependence on interest rates for benchmarking. In addition, using the proposed rental rate (RR-I) reduces the exposure to the subjective evaluation by property valuators and speculative macroeconomic elements.

Keywords Islamic home financing, Autoregressive distributed lag model, Impulse responses functions, Musharakah Mutanaqisah, Rental price, Residential rental index

Paper type Research paper

1. Introduction

Unlike conventional finance that is interest based, Islamic finance prohibits the use of interest in any transaction. All Islamic finance contracts are asset-based contracts and are either, equity based, trade based or leasing based. In equity-based contracts, the lending institution enters into partnership with the borrower based on the principle of profit and loss sharing. In home financing, a problem arises on how to calculate the profit and losses as a replacement for the mortgage rate (MORT). In this paper, we propose the use of an Islamic rental rate (RR-I) as opposed to MORT in pricing home finance by Islamic financial institutions. This paper therefore investigates the proposed rental rate (RR-I) and its macroeconomic determinants with the purpose to show that the rental rate (RR-I) could be a viable alternative to MORTs if it is independent from interest rates.

Finding an alternative to MORTs for home financing is also promising, as the recent literature incriminates interest rates and their volatility as one of the main factors causing the collapse of the housing market in 2007-2008 which translated to global financial crisis. It is therefore imperative to explore the possibility of an alternative pricing for home loans which is free from interest especially in Islamic financial system which prohibits interest (*riba*) and promotes equity participation as a risk sharing mechanism. We posit that a new measure of the rate of return for the bank and the cost of owning an asset should truly capture the physical attributes of the property and thus not linked to any form of interest rates.

The relationship between housing prices and MORTs has been extensively investigated mainly in the aftermath of the financial crisis in an attempt to shed some light on the factors that fueled the mortgage crisis not only in the USA but also globally. Several studies have concluded on a negative and significant link between the change in interest rates among other factors and the change in house prices. For instance, one of the main contributions is that by Hubbard and Mayer (2009) who examine the behaviour of house prices in an attempt to consider the role of interest rates, the mortgage market and other fundamental factors in explaining the boom-bust cycle of the 2000s. In their paper, Hubbard and Mayer (2009) point out that it is the convexity of the relationship that explains the housing market collapse. When interest rates are very low, a small increase in interest rates will have a dramatic negative impact on house value and vice versa. The authors therefore argue that the lower the level of interest rates, the more sensitive are house price changes to movements in interest rates.

In this paper, we seek to contribute to the banking and housing market literature by exploring on the possibility of using a newly proposed rental rate measured by the ratio of the rental index to the house price index (HPI) as an alternative Islamic mortgage pricing mechanism. Particularly in the context of a developed country with a matured

housing market such as in the UK, where Islamic banking has gained phenomenal significance over the past decade, this study attempts to highlight the potential of rental rate as an alternative to interest rate. The rest of the paper is organized as follows. Section 2 presents an overview of Islamic home financing in the UK, Section 3 highlights the theoretical underpinnings and existing literature on Islamic mortgage. Section 4 discusses the data and methodology, followed by the findings and analysis in Section 5. Finally, Section 6 concludes the paper by discussing the implications of the findings, limitations of the study and avenues for further research.

2. Overview of Islamic home financing in the UK

According to Islamic Finance News Report (2015), the UK has one of the most advanced Islamic financial markets in the Western world and has the largest Islamic banking sector outside the Middle East and Asia. Islamic mortgage market in the UK is gaining ground in catering to the needs of nearly 3 million Muslim minorities, representing around 4.8 per cent of the total population in the UK as well as Muslims particularly from the Middle East, who are keen to own properties in the UK as holiday residence but are reluctant to engage in interest-bearing financing facility (Asutay, 2012). Therefore, the supply of innovative Islamic mortgage products by Islamic banks may boost the housing market.

Islamic banks in the UK generally offer three types of mortgage products based on the principles or contracts that are *shariah*-compliant, namely, *Murabaha* (Cost Plus Sale), *Al-ijarah muntahia bil tamleek* or sometimes referred to as *Ijarah wa iqtina* (Leasing ending with a sale) or *Musharakah Mutanaqissah* (MM) (Diminishing partnership). *Murabaha* is typically a sale contract whereby the bank purchases the property identified by the customer from the developer and then resells it to the customer at a marked up price. The customer then pays the bank in instalments at an agreed financing period with the title of the property being charged to the bank as collateral until all payments are settled. The instalments paid by the customer must be fixed, as it is a sale contract with an agreed fixed price and thus, is not dependent on the interest rate fluctuations. *Ijarah*, on the other hand, is a leasing contract whereby the customer of the bank undertakes to purchase the usufruct of the asset. In home financing, the bank will purchase the property identified by the customer and rents it to the customer over the financing period. At the end of the financing period, the bank then sells the property to the customer at an agreed price. The monthly instalment charged by the bank is normally comparable to the prevailing compounded interest-based loan offered by conventional banks. *Musyarakah Mutanaqisah* (MM) or Diminishing Partnership is a relatively new innovation in Islamic home financing products which is not found in Islamic classical literature. It is one of the most recent modes of mortgage financing offered by the five Islamic banks in the UK, namely, Al- Buraq (Arab Banking Corporation), Al- Rayan Bank (formerly Islamic Bank of Britain), United National Bank (Pakistan-based), Ahli United Bank and HSBC Amanah. Unlike the first two products which to some extent are dependent on interest rate benchmarks, MM should be based on the actual rental value of the property and as such is deemed more *shariah-compliant*. However, based on scrutiny of the banks' websites, the rental rates imposed by most banks are found to be still tied to London Interbank Offered Rate (LIBOR) or the conventional interest rates without referring to the actual rental values of the property.

As MM or Diminishing Partnership depends on rental value, we investigate the macroeconomic determinants of residential rental index with a view to potentially adopt rental rate in this paper [measured by the ratio of the rental price index (RPI) to the HPI] in the pricing of mortgages by Islamic banks in the UK. Thus, our paper is novel, as no studies in the UK context has considered how to price mortgages, especially Islamic home financing, without using interest rates as proxies.

3. Islamic rental rate as alternative pricing mechanism

A typical housing loan or mortgage provided by conventional banks is secured by real property and a schedule of payments of interest and repayments of the principal to a bank is drawn. The contract between the borrower and the conventional bank is a loan contract and the bank has a lien over the property loaned which restricts the ability of the borrower (owner) to sell the real property without the bank's permission. Moreover, conventional banks normally impose compounding of interest in cases where the borrower defaults and banks transfer the risk to the home buyers by requiring them to pay interest independent of the return on the investment and/or condition of the home buyer. On the other hand, home financing products offered by Islamic banks must adhere to the s*hariah*, the legal code of Islam which prohibits interest and compounding the payment for borrowers' default, and also requires sharing of the risk inherent in owning the property in partnership-based financing.

Various Islamic housing products have been approved by *shariah* scholars including MM or diminishing partnership, which is generally an equity-based financing combined with *ijarah* (rental). Although the mechanism had been approved by the First International Conference on Islamic Banking held in Dubai in 1979, it has not been extensively implemented by Islamic financial institutions around the globe (Bendjilali and Khan, 1995; Smolo and Hassan, 2011) compared to murabaha (cost-plus) financing. Unlike Murabahah which tends to rely on interest rate benchmark, MM uses the actual rental value of the property and is thus deemed to be more *shariah*-compliant. Meera and Abdul Razak (2009) highlight a number of features that make MM housing product superior. First, in theory, the value of the house under MM always reflects the market price as captured by the rental rate values or the agreed price at the time of acquisition. Second, unlike cost-plus products where the return is based on a fixed selling price (which is also benchmarked against the prevailing market interest rate), MM does not require the rental payment to be fixed nor be benchmarked against the conventional interest rate. Hence, the rental rate is more stable and not susceptible to changes and volatilities in macroeconomic conditions throughout the period of financing. Furthermore, the rental rate can also be revised periodically by incorporating the selected macroeconomic indicators to reflect the current changes in macroeconomic variables. Third, banks can manage the liquidity risk better, as rental payments can be adjusted at the end of the subcontract period, subject to mutual consent by both customers and the banks. This is different from other products that only allow a fixed rate of return without making adjustments for macroeconomic conditions throughout the financing period. Fourth, the balance under MM contract can never be larger than the original price of financing even when compared to floating rate products, as the discounted rate of rental in terms of the increase in the value of customer's share in the property can be pre-contractually determined. Finally, the structure of MM is more

flexible, as it allows the customer to fully redeem his/her share from the bank earlier without the need to compute rebates.

Prominent *shariah* scholars have also unanimously agreed that the use of actual rental value of property as a benchmark brings many benefits including a better reflection of the market condition and presents a true value of the property besides being free from interest. Usmani (2004) emphasizes that the rental must be determined at the time of the contract for the whole leasing period, and 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. If the rental for subsequent phase of tenure is not yet determined at the onset of the first phase of the tenure and is left only at the option of the lessor, the lease is considered invalid. This view supports that of Al-Zuhayli (2003) who concludes that a sale without a price is invalid, and thus renting without a price is also considered invalid. Al-Zuhayli (2003) further highlights that a sale should not comprise uncertainty or ignorance, coercion, time restriction, uncertain specification, harm and corrupting conditions (Meera and Abdul Razak, 2009). The scholars further opine that although the use of interest rate as a benchmark is permissible, Islamic banking operators need to change their mindset and develop their own benchmark (Meera and Adul Razak, 2009).

While MM has less issues from the *shariah* perspective, concerns have been raised on its practicality which, among others, include contract-based complexities, agency problem, trustworthiness, duration as well as determination of the price of the shares and determination of rental in accordance with market forces (Smolo and Hassan, 2011; Meera and Abdul Razak, 2009, 2005; Bendjilali and Khan, 1995). One of the issues highlighted being the convergence between the practice in conventional home financing and MM. For instance, unlike rental rate, the bank's cost of fund is still attached to the prevailing interest rates which tend to be normally higher than the rental rate in periods of high interest rates and lower than the interest rates in period of very low interest rates. Using the rental rate, on the other hand, requires the services of the property valuers whose judgements are often very subjective and not truly reflective of the actual value of the property as well as the existing macroeconomic conditions. Meera and Abdul Razak (2009) attempt to tackle some of the practical issues by incorporating variable rental rates, variable house property values, estimating new rental values and rental rates. In their proposed solution, the rental value is based on assumptions, but in practice, it is still arbitrarily determined.

Yusof *et al.* (2011) analyse the possibility of relying on the rental rate to price Islamic home financing product in Malaysia instead of the conventional interest-based lending rate (LR). They document evidence that the rental rate is resilient to short-term economic volatilities, while in the long run, it truly captures the economic fundamentals.

In this paper, we propose to measure the rental rate by the ratio of actual values of quarterly RPI to the actual value of HPI to capture the rate of return on rental properties in the case of UK housing market, more precisely the London residential market. Using the data on London as a proxy for UK market can be justified, as London is the most important residential market in the UK. Nevertheless, we can expect to fairly generalize the results of this present study to other markets in the UK.

The rental rate proposed here captures the true rate of return of owning a house and, at the same time as evidenced in other studies like Hui *et al.* (2007), Marco (2007), Adegoke (2014), truly captures the physical attributes of the property (captured by

rental index) and its market price (captured by HPI). This rate can therefore serve as a benchmark, as it represents all types of houses across all locations in London. It is not within the ambit of our study to analyse the impact of physical attributes on rental markets across locations. With this proposed rental rate (RR-I), we then examine its macroeconomic determinants particularly whether it is dependent on the different types of interest rates in UK.

As pricing of MM mortgages requires knowledge on the potential rental value and rental rate, we empirically investigate the macroeconomic determinants of rental index in London from 2005 to 2014. We also compare the results by first investigating the macroeconomic determinants of rental price alone (measured by just rental index) to see the significance of the macroeconomic determinants of both rental price (RPI) and rental rate (RPI/HPI). In this study, we postulate that the proposed rental rate should not be impacted by any forms of interest rates; moreover, it is not susceptible to volatilities in market conditions and speculations. This would make it as an ideal Islamic home financing pricing mechanism (riba-free).

3.1 Rental rate and macroeconomic variables

Studies conducted on the determination of the price of home financing, its susceptibility to inflation, viability and determinants of rental rates within the macroeconomic framework and its link with Islamic Home Financing is meagre. Among the earlier studies on the viability of rental rate is by Yusof *et al.* (2011). This study compares two models consisting of either rental rate or LR and selected macroeconomic variables that could influence property value. By using the Malaysian data covering the period from 1990 to 2006, the study adopts several econometric time-series analyses, such as the autoregressive distributed lag estimates, bi-variate Granger causality and multivariate causality based on the vector error-correction model. The results of the study suggest that rental price is a better alternative than LR to price Islamic home financing product. In particular, the rental rate is found to be resilient to short-term economic volatility, while in the long run, it is truly reflective of the economic fundamentals.

Thorough analysis should incorporate all set of potentially relevant data which could reflect the degree of contribution of physical factors in determining the rental rate of the property. Ideally, the model should be comprehensive enough such that it includes all the significant attributes in arriving at the property's rental rate. However, due to the complexity of the housing market which is considered as multi-dimensional and highly differentiated, several studies focus on just the major attributes determining house prices or rental rate for a particular location. Marco (2007), for example, focuses on the location and demographic attributes in determining rental rate in the New York City neighbourhoods. In a related study, Hui *et al.* (2007) analyse the importance of physical characteristics (which include age, total floor area and occupancy rate), market position and location of the property as the possible factors determining the rental rate of the property in Hong Kong. Ibrahim *et al.* (2005) test the possible importance of physical characteristics (floor area and floor level), distance from central business district and distance from mass rapid transit station in determining the rental rate in various sub-markets in Singapore. More recently for Nigeria, Adegoke (2014) provides evidence that depending on the different types of densities and different types of building, specific physical attributes of the property are found to critically influence the rental values. For instance, number of bedrooms, number of living rooms and existence of burglar alarm

are the critical factors in determining rental values of bungalows, while some other attributes like number of toilets are critical to duplex.

Other studies analyse the relevance of macroeconomic variables in determining the rental values of property, such as economic output [gross domestic product (GDP)], prime interest rate and vacancy rate (Chow *et al.*, 2002) and consumer expenditure, employment and economic output (White *et al.*, 2000). The study by Matysiak and Tsolacos (2003) analyses rental pricing from a different dimension by examining the role of selected economic and financial series which are used as leading indicators in explaining the monthly variation in property rents in the UK. The leading indicators comprises five financial variables [Treasury Bill rate, yield of 20-year gilts, narrow money supply, broad money supply and price on financial times stock exchange (FTSE)], three real economic variables (car registration, volume of retail sales and job vacancies) and two sentiment indicators (consumer confidence and expectations in the property market development). Other economics-related variables are also used to predict average rental rate adjusted for inflation like occupancy rate, change in employment and change in population (Hanna *et al.*, 2013). Studies conducted specifically on real estate returns measured in terms of prices and rental values are also conducted by De Wit and Van Djik (2003) on Asia, Europe and US cities. They find that GDP and inflation positively affect office prices and office rentals. For the UK market, Kohlert (2010) also documents evidence that macroeconomic determinants such as GDP, total investment and unemployment affect real estate returns. By using GMM for the data running from 2000 to 2007, Fereidouni and Bazrafshan (2012) find that inflation, population, GDP and unemployment in Iran affect the returns on housing.

In the literature about the determinants of rental values, the various variables that have been found as possible factors are presented in the Table I below.

It seems obvious from all the above studies that the rental value is determined by the physical attributes of the property. However, the question that remains unanswered is whether the rental value, and more importantly for us the rental rate, is linked to MORTs. Therefore, our strategy here is to investigate the macroeconomic determinants of RPI and of the rental rate and to assess the link with the different measures to interest rates.

In modelling both the rental price and rental rate, we focus on three different measures of LRs, namely, the base rate (BR), the LIBOR and the MORT in the UK as well as two other macroeconomic variables, namely, the real effective exchange rate (REER) and the GDP. The REER reflects the change in the purchasing power of the Great Britain Pound compared to the currencies of the country's trading partners. The assumption is that low exchange rates make the real estate market more attractive to foreign investors in the short run. However, in the long run, there is a balancing effect, and thus we could observe a positive relationship between exchange rate and the rental market (Dornbush, 1985; Kuttner and Shim, 2012).

4. Data and methodology

4.1 Data

The data available for this study covers the period from Quarter 1 of 2005 to Quarter 2 of 2014. The main sources for the data are the UK Office for National Statistics, IMF and Bank of England.

Attributes	Variables measuring the attributes
Physical attributes	Structural: number of bedrooms, number of bathrooms, number of living rooms, number of toilets, existence of burglar alarm, floor area, age of property, floor level and occupancy rate
Locational attributes	Demographic: median household incomes, crime rate, cultural attractions; poverty rate, percentage of public housing and racial diversity index
	Policy-specific: rent regulations and rent subsidies
	Amenities/facilities: availability of in-door pools, gymnasiums and covered parking
	Neighbourhood: quality of schooling system, level of noise pollution, air quality, proximity to parks, proximity to bodies of water, quality of transportation system
	Distance from central business district
Economic attributes	Economic output (GDP)
	Interest rates: prime interest rate, Treasury Bill rate
	Consumer expenditure: volume of retail, sales consumer sentiment consumer confidence and expectations in the property market development
	Employment (job vacancies)/Unemployment
	Money supply
	Stock price
	Inflation
	Total investment

Table I.
Factors affecting rental rate of property

Table II presents a summary of the variables, measurement methods and data source.

4.2 Methodology

To enhance our understanding of the significant effects of interest rates on the rental prices and our proposed RR-I, we assess all three types of interest rates, namely, BR, MORT and LIBOR. Our analysis starts with first examining the link between RPI and various macroeconomic variables, i.e. GDP, REER and interest rate (BR, LIBOR and MORT). This is then followed by assessing the link between rental rate (RR-I) which is measured by RPI/HPI and the same macroeconomic variables.

We use time series analysis which involves the standard procedure for testing the stationarity of the variables of the models using unit root test and estimation of long-run relationship by conducting co-integration analysis. To explain how each macroeconomic variable shock affects the dynamic path of all of the variables of the system in the short run, this study also performs impulse response function (IRF) and forecast error variance decomposition (FEVD) based on vector autoregression (VAR) model. Table III summarizes the time series analysis techniques used in this study corresponding to three research objectives.

The autoregressive distributed lag model (ARDL) model used in this study can be expressed as the following general models:

Table II. Summary of data measurement and sources

Variables	Measurement	Period	Sources
Rental price index (RPI)	Change in price of renting residential property from private landlords in London	Q1 2005 to Q2 2014	UK Office for National Statistics
Gross domestic product (GDP)	Gross domestic product, 2011 = 100	Q1 2005 to 2Q 2014	UK Office for National Statistics
Real effective exchange rate (REER)	Real effective exchange rate based on consumer price index, 2010	Q1 2005 to Q2 2014	International Monetary Fund (IMF) – International Financial Statistics
Base rate (BR)	End of period base rate of Bank of England	Q1 2005 to Q2 2014	Bank of England
London Interbank Offered Rate (LIBOR)	End of period LIBOR 3-month	Q1 2005 to Q2 2014	Bank of England
Mortgage Rate (MORT)	Lifetime Tracker Mortgage to Households	Q1 2005 to Q2 2014	Bank of England

Research objectives	Time series analysis techniques
To test whether there is a long-run co-integration between macroeconomic variables (i.e. GDP, REER, BR, LIBOR and MORT) and rental price index and rental rate	ARDL (bound testing co-integration approach)
To test whether there is short-run relationship between macroeconomic variables (i.e. GDP, REER, BR, LIBOR and MORT) and rental price index and rental rate	Impulse response function (IRF)
To measure the influence of each macroeconomic variable (i.e. GDP, REER, BR, LIBOR and MORT) and rental price index and rental rate	a. ARDL (long-run coefficient estimates) b. Forecast error variance decomposition (FEVD)- short-run

Table III.
Research objectives and time series analysis techniques

Residential RPI:

$$RPI_t = \alpha_0 + \alpha_1 GDP_t + \alpha_2 REER_t + \alpha_3 BR + e_t \quad (1)$$

$$RPI_t = \alpha_0 + \alpha_1 GDP_t + \alpha_2 REER_t + \alpha_3 MORT + e_t \quad (2)$$

$$RPI_t = \alpha_0 + \alpha_1 GDP_t + \alpha_2 REER_t + \alpha_3 LIBOR + e_t \quad (3)$$

Rental rate (RRI):

$$RRI_t = \alpha_0 + \alpha_1 GDP_t + \alpha_2 REER_t + \alpha_3 BR + e_t \quad (4)$$

$$RRI_t = \alpha_0 + \alpha_1 GDP_t + \alpha_2 REER_t + \alpha_3 MORT + e_t \quad (5)$$

$$RRI_t = \alpha_0 + \alpha_1 GDP_t + \alpha_2 REER_t + \alpha_3 LIBOR + e_t \quad (6)$$

where GDP = gross domestic product; REER = real effective exchange rate; BR = base rate by Bank of England; MORT = mortgage rate; LIBOR = LIBOR 3-month.

4.2.1 Autoregressive distributed lag model bound testing co-integration approach (long-run analysis). In time series, stationarity of variables is important as applying least squares regressions on non-stationary variables can give incorrect parameter estimates. Unit root test is used to verify whether a variable is stationary at level, *I(0)* or stationary at first differencing, *I(1)*.

There are several co-integration techniques that 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 by Johansen (1991), and ARDL model by Pesaran *et al.* (1996). In this paper, we use ARDL 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 is robust against simultaneous equation bias and autocorrelation problem 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, ARDL model is selected as the

most appropriate for this study. The error-correction representation of the ARDL models of this study can be expressed as follows:

$$\Delta \ln RPI_t = a_0 + \sum_{j=1}^{k1} b_j \Delta \ln RPI_{t-j} + \sum_{j=0}^{k2} c_j \Delta \ln GDP_{t-j} + \sum_{j=0}^{k3} e_j \Delta \ln REER_{t-j} + \sum_{j=0}^{k4} f_j \Delta BR_{t-j} + n_1 \ln RPI_{t-1} + n_2 \ln GDP_{t-1} + n_4 \ln REER_{t-1} + n_5 BR_{t-1} + \epsilon_t \quad (7)$$

$$\Delta \ln RPI_t = a_0 + \sum_{j=1}^{k1} b_j \Delta \ln RPI_{t-j} + \sum_{j=0}^{k2} c_j \Delta \ln GDP_{t-j} + \sum_{j=0}^{k3} e_j \Delta \ln REER_{t-j} + \sum_{j=0}^{k4} f_j \Delta MORT_{t-j} + n_1 \ln RPI_{t-1} + n_2 \ln GDP_{t-1} + n_4 \ln REER_{t-1} + n_5 MORT_{t-1} + \epsilon_t \quad (8)$$

$$\Delta \ln RPI_t = a_0 + \sum_{j=1}^{k1} b_j \Delta \ln RPI_{t-j} + \sum_{j=0}^{k2} c_j \Delta \ln GDP_{t-j} + \sum_{j=0}^{k3} e_j \Delta \ln REER_{t-j} + \sum_{j=0}^{k4} f_j \Delta LIBOR_{t-j} + n_1 \ln RPI_{t-1} + n_2 \ln GDP_{t-1} + n_4 \ln REER_{t-1} + n_5 LIBOR_{t-1} + \epsilon_t \quad (9)$$

$$\Delta \ln RRI_t = a_0 + \sum_{j=1}^{k1} b_j \Delta \ln RRI_{t-j} + \sum_{j=0}^{k2} c_j \Delta \ln GDP_{t-j} + \sum_{j=0}^{k3} e_j \Delta \ln REER_{t-j} + \sum_{j=0}^{k4} f_j \Delta BR_{t-j} + n_1 \ln RRI_{t-1} + n_2 \ln GDP_{t-1} + n_4 \ln REER_{t-1} + n_5 BR_{t-1} + \epsilon_t \quad (7a)$$

$$\Delta \ln RRI_t = a_0 + \sum_{j=1}^{k1} b_j \Delta \ln RRI_{t-j} + \sum_{j=0}^{k2} c_j \Delta \ln GDP_{t-j} + \sum_{j=0}^{k3} e_j \Delta \ln REER_{t-j} + \sum_{j=0}^{k4} f_j \Delta MORT_{t-j} + n_1 \ln RRI_{t-1} + n_2 \ln GDP_{t-1} + n_4 \ln REER_{t-1} + n_5 MORT_{t-1} + \epsilon_t \quad (8a)$$

$$\Delta \ln RRI_t = a_0 + \sum_{j=1}^{k1} b_j \Delta \ln RRI_{t-j} + \sum_{j=0}^{k2} c_j \Delta \ln GDP_{t-j} + \sum_{j=0}^{k3} e_j \Delta \ln REER_{t-j} + \sum_{j=0}^{k4} f_j \Delta LIBOR_{t-j} + n_1 \ln RRI_{t-1} + n_2 \ln GDP_{t-1} + n_4 \ln REER_{t-1} + n_5 LIBOR_{t-1} + \epsilon_t \quad (9a)$$

The short run dynamics is added in the above equations (7)-(9a) and are represented by the terms with the summation signs, while the long-run relationship is represented in the second part and c1 ε_t refers to the random error term.

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 (Pesaran *et al.*, 2001; Narayan, 2005). *F*-test has a non-standard distribution which depends on whether variables are *I*(0) or *I*(1), number of regressors, number of observations and whether the ARDL model has an intercept and/or a trend (Narayan, 2005).

The structural stability tests are performed using cumulative sum of recursive residual (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ). The null hypothesis that all coefficients in the ECMs as in the ARDL models for Rental Index (RPI) are stable and cannot be rejected if the plots of the CUSUM and CUSUMSQ statistics are established within the critical bounds of 5 per cent significance level. Conversely, the null hypothesis of the stability of coefficients can be rejected if the lines are found to be crossed. We use the critical values proposed by Pesaran *et al.* (2001).

The model selection of this study is carried out using Aikaike Information Criterion (AIC). 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 fast variables return to equilibrium. A relatively high ECM coefficient in absolute amount indicates a quicker adjustment process.

4.2.2 Impulse response function and forecast error variance decomposition (short-run analysis). To test the response of RPI and Rental Rate to the short run impacts of the selected macroeconomic variables, we use the IRFs. If there is a significant reaction of RPI or RRI to a shock in the macroeconomic variables, a causal relationship can be established. We also use the FEVD to examine the strength of each variable to the overall, unpredictable variance of another variable over time.

We adopted the procedure of orthogonalizing the VAR's shocks to reduce the risk of contemporaneous correlations between shocks in the different variables.

The ordering adopted for this study is similar to that of Hofmann (2004) where the ordering is real GDP, RPI, interest rate and REER. This ordering assumes that real GDP does not respond contemporaneously to shocks of any of the other variables but may influence all other variables within the quarter. Interest rate is considered flexible, as it responds within a quarter to shocks of real GDP. The chosen ordering also reflects the typical assumption that changes in interest rates are transmitted to the economy with a lag.

According to Koop *et al.* (1996), Pesaran and Shin (1998), generalized IRF avoids the ordering problem inherent in the orthogonalized impulse responses. 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.

5. Findings and analysis

In this section, we start our analysis by examining the correlation between HPI and RPI in the UK for the period running from January 2005 to March 2014. Based on correlation analysis, the correlation between RPI and HPI is 0.895738, and it is significant at less

than 1 per cent significance level. The graphs below further illustrate the strong correlation between RPI and HPI in the UK (Figure 1).

Results of autoregressive distributed lag model for rental price index are presented in Table IV.

Table IV shows the ARDL model selected by SBC and *F*-statistics for ARDL models for BR, MORT and LIBOR.

5.1 Results of rental price index model

5.1.1 Results of autoregressive distributed lag model analysis. As evidenced in Table IV, the computed *F*-statistics for all models indicate that there are co-integrating relationships among the selected variables at the selected lag length. The findings suggest that RPI in the UK is significantly linked to the selected macroeconomic variables. The findings are consistent with the studies of Chow *et al.* (2002), Matysiak and Tsolacos (2003), White *et al.* (2000), which find that GDP and interest rates affect rental values of property. Our findings also support those studies on real estate returns by De Wit and Van Djik (2003), Kohlert (2010) and Fereidouni and Bazrafshan (2012), which find that macroeconomic determinants like GDP affect the real estate returns measured by rental values.

The next step is to test the stability of all ARDL models. Figure 2 illustrates the CUSUM and CUSUMSQ tests for all three interest rate models, and the results suggest no evidence of any significant structural instability.

Table V presents the long-run ARDL model estimates. Based on Model 1 – BR Model, results indicate GDP and the BR to significantly affect rental price in the long run at 1 per cent significance level.

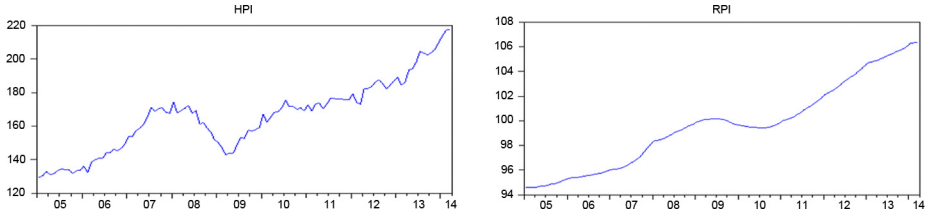


Figure 1.
The strong correlation between RPI and HPI in the UK

Co-integration hypotheses	*F*-statistics
F(RPI GDP, REER, BR)	5.9236**
F(RPI GDP, REER, MORT)	4.9452**
F(RPI GDP, REER, LIBOR)	5.7367**

Notes: [a] *F*-statistics falls above; **5% critical boundsn; The relevant critical value bounds are taken from Narayan's (2005) Appendices A1-A3 for Case IV: with unrestricted intercept and restricted trend. We estimate the *F*-statistics for 38 observations by using 35 and 40 number observations with three regressors in the table. Based on 35 observations, relevant critical value bounds at 5% significance level are at 3.936-4.918. On the other hand, based on 40 observations, relevant critical value bounds at 5% significance level are 3.850-4.782

Table IV.
Bound-testing procedure results[a]

For the MORT Model (Model 2), it is interesting to note that while GDP does not significantly affect rental price in the long run, the REER and MORT are found to be significant at the 1 and 5 per cent significance level, respectively. With an open market such as in the UK which attracts increasing number of expatriates and migrants, it is therefore not surprising that the exchange rate affects the demand for the rental market. The finding for Model 3 – LIBOR is consistent with Models 1 and 2, where macroeconomic variables affect rental price especially all types of interest rates (BR, MORT and LIBOR).

Table VI shows the ECM coefficients of all ARDL models. The results in the table further suggest that for all three models, the ECMs' coefficients have the correct

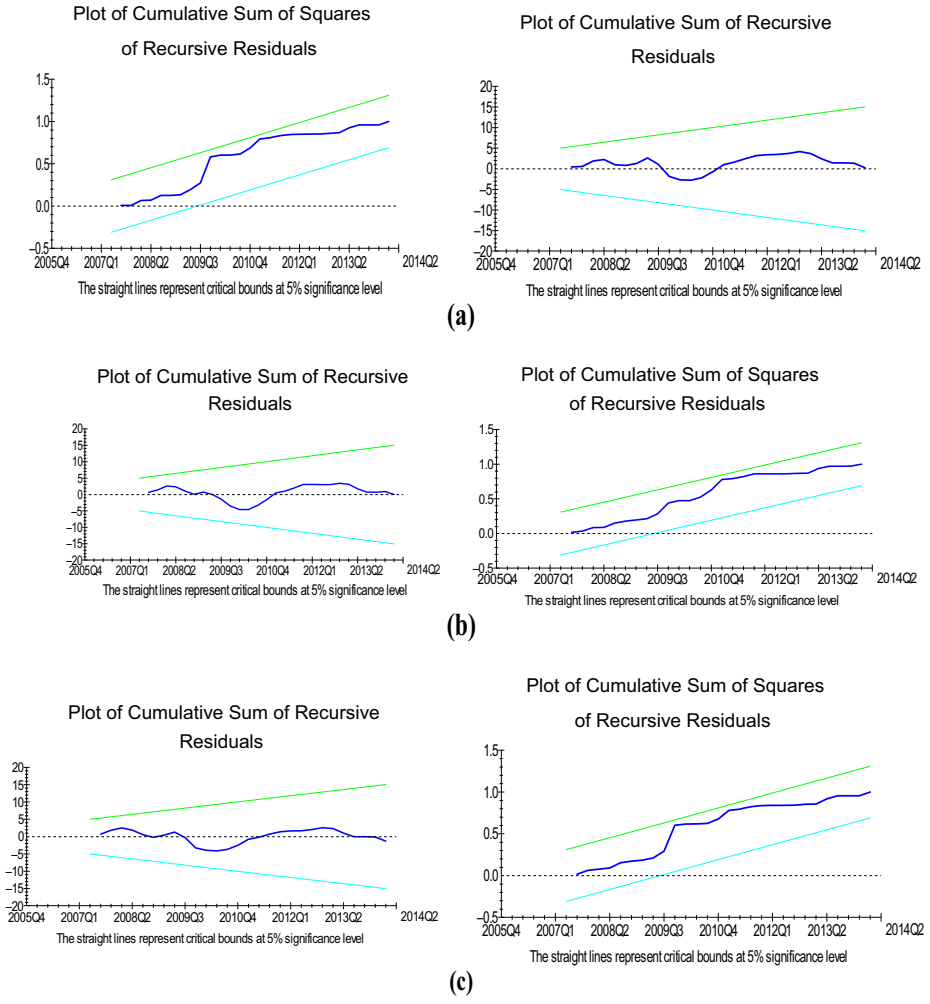


Figure 2.
CUSUM and CUSUMSQ

Notes: Tests for interest rate models: (a) BR model; (b) MORT model; and (c) LIBOR model

Regressors	Model 1 – Base rate model Base rate model	*T*-ratio	Model 2 – Mortgage rate model Mortgage rate model	*T*-ratio	Model 3 – LIBOR model LIBOR model	*T*-ratio
GDP	−72.8098	−3.0247***	−25.2285	−1.5226	−51.3296	−1.7378*
REER	0.031578	1.0256	0.097535	3.0739***	0.057623	1.8233*
BR	146.6660	3.3823***	N/A	N/A	N/A	N/A
LIBOR	N/A	N/A	N/A	N/A	107.2225	2.3148**
MORT	N/A	N/A	79.5281	2.2060**	N/A	N/A
Constant	2025.4	3.1602***	750.7700	1.7136*	1450.6	1.8470*
Intercept	0.67384	7.0336***	0.46182	7.7809***	0.60274	5.2186***

Notes: ***at 1% significance level; **at 5% significance level; *at 10% significance level

Table V.
Long-run ARDL model estimates for RPI

negative signs and are significant. This further substantiates our earlier findings of the existence of co-integration among the variables in the long run.

5.1.2 Results of impulse response functions. To further investigate on the short run dynamics, the study adopts the generalized impulse function to perform the IRF analysis, as it avoids the ordering problem inherent in the orthogonalized impulse responses (Pesaran and Shin, 1998). Figure 3 illustrates the results of IRF analysis based on the three interest rate models.

Based on the results of the three interest models (Models 1-3) above, we find that in the short run, none of the selected macroeconomic variables affect rental price. This finding suggests that at least in the short run, rental price is not significantly linked to macroeconomic variables, and it is plausible that other determinants such as physical attributes, location and social factor can affect the variations of rental prices in the UK during the period of analysis.

5.1.3 Results of forecast error variance decomposition. To perform the FEVD analysis, this study adopts the following ordering: GDP, RPI, interest rate [BR, MORT, LIBOR 3-month (LIBOR)] and REER. For robustness check, another ordering is performed as follows: RPI, GDP, interest rate [BR, MORT, LIBOR 3-month (LIBOR)] and REER. Table VII presents the results of the FEVD analysis.

From the results presented in Table VII, it can be seen that all three types of interest rates contribute to only 1-4 per cent of shocks in rental price for both sets of orderings. At this juncture, we can thus infer that although macroeconomic variables, particularly interest rates, affect rental price in the long run; however, they do not significantly affect rental price in the short run.

Changed	Model 1 – Base rate model	*T*-ratio	Model 2 – Mortgage rate model	*T*-ratio	Model 3 – LIBOR model	*T*-ratio
ecm (−1)	−0.19043	−5.7510***	−0.17047	−5.2020***	−0.16997	−5.1961***
R^2	0.86571		0.85202		0.85326	
Durbin–Watson	2.1130		2.2438		1.9308	

Notes: *at 10% significance level; **at 5% significance level; ***at 1% significance level

Table VI.
ECM coefficients of ARDL models

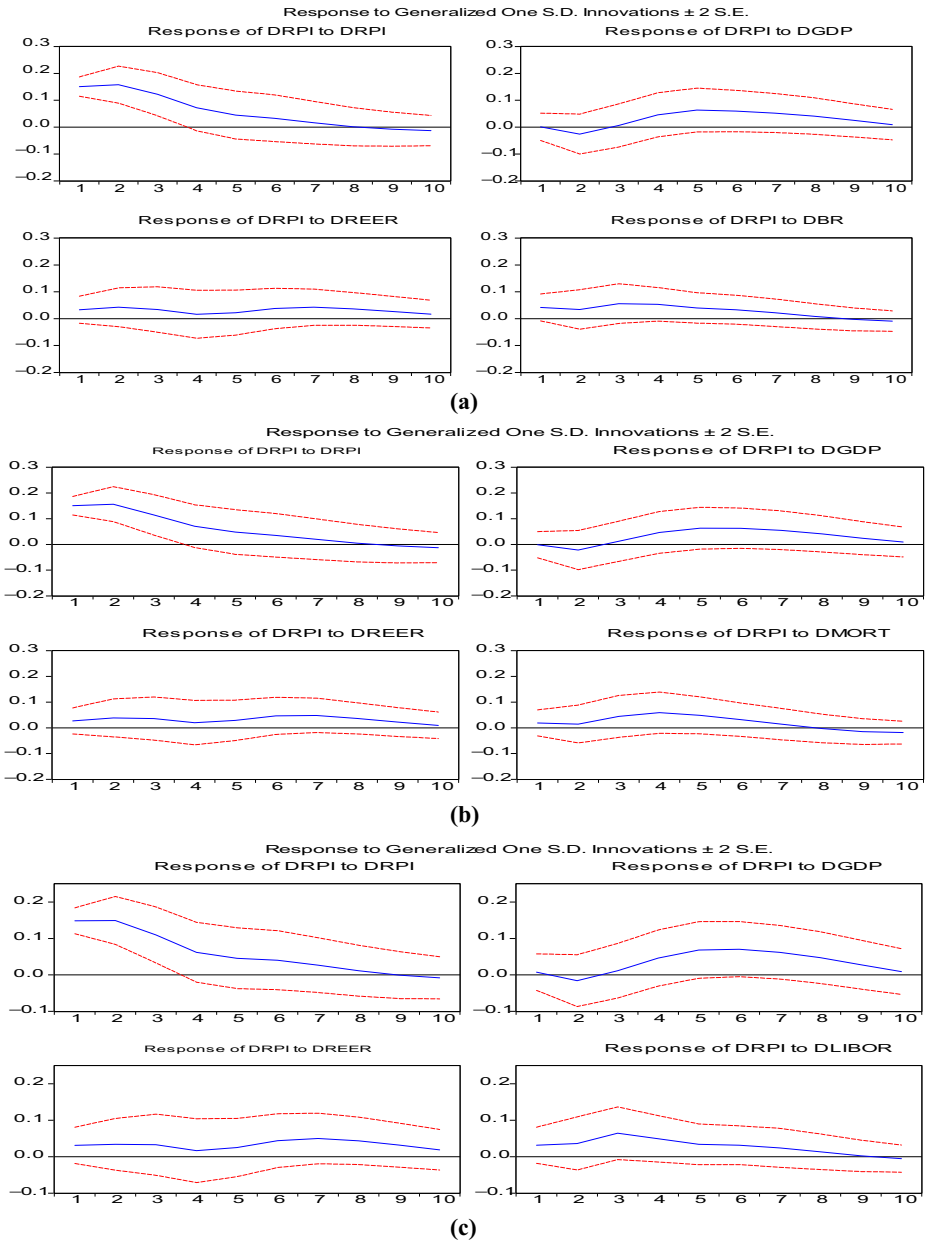


Figure 3.
IRF results on interest rate models

Notes: (a) Model 1: BR as interest rate; (b) Model 2: MORT as interest rate; (c) Model 3: LIBOR as interest rate

5.2 Results for Islamic rental rate model

We further extend our analysis by incorporating House Price into the equation, i.e. RPI/HPI to capture the macroeconomic determinants through their links with HPI.

5.2.1 Results of autoregressive distributed lag model (long run analysis). Table VIII presents the ARDL model selected by SBC and *F*-statistics for ARDL models for BR, MORT and LIBOR.

As evidenced in Table VIII, the computed *F*-statistics for all models indicate that there are no co-integrating relationships among the selected variables at the selected lag length. The insignificance of macroeconomic variables in the long run enable us to interpret that our proposed rental rate (RR-I) is resilient and not susceptible to fluctuations in macroeconomic variables, particularly the interest rates. The next step is to test the stability of all ARDL models. Figure 4 illustrates the CUSUM and CUSUMSQ tests for all three models of interest rate, and it can be seen that the results for all models suggest no evidence of any significant structural instability. Due to non-co-integration relationship between rental rate and macroeconomic variables, our analysis on rental rate is more focused on the short run dynamics.

5.2.2 Results of impulse response functions. The study adopts the generalized impulse function to perform the IRF analysis, as it avoids the ordering problem inherent in the orthogonalized impulse responses (Pesaran and Shin, 1998). Figure 5 illustrates the findings of IRF analysis. The response of RR-I to GDP is significant in the first three quarters and after that it tapers off. However, the response of RR-I to changes in the different measures of the interest rates is not significant. These results suggest that our proposed rental rate is resilient to changes in interest rates but impacted by the short-term changes in the GDP.

5.2.3 Results of forecast error variance decomposition. To perform the FEVD analysis, this study adopts the following ordering: GDP, rental rate index (RRI), interest rate [BR, MORT, LIBOR 3-month (LIBOR)] and REER. For robustness check, another ordering is performed as follows: rental rate index (RRI), GDP, interest rate [BR, MORT, LIBOR 3-month (LIBOR)] and REER. Table IX presents the results of FEVD analysis.

Based on the results of FEVD presented in Table IX, it can be seen that similar to the case of rental price, for rental rate (RR-I), the percentage attributable to shocks in interest rates is not significant and accounting for not more than 11 per cent. The findings on RR-I affirm our contention that rental rate (RR-I) is not significantly affected by macroeconomic variables in the long run, and, in addition, interest rates do not matter in the short run. These results also corroborate our earlier findings of the IRFs, where the GDP changes show some influence on this new measure of rental rate. Thus, we propose that Islamic banks adopt this rental rate as a new measure of their rate of return in the Islamic home financing, as it captures the growth of the real economy without being linked to any forms of interest rates. Although benchmarking rental to interest rate is permissible in Islam, it is high time that Islamic banks establish their own benchmarking as an alternative to interest rate and perhaps rental rate measured in terms of RPI/HPI can play the vital role.

6. Conclusion and recommendation

This study proposes a new method for pricing home financing that could be a viable alternative to MORTs. As Islamic banks are not expected to charge interest rates but should charge a profit rate that is more linked to the real profitability of the asset, a rental rate calculated as the ratio of RPI to the RPI/HPI would be a more relevant profit

Table VII.
Results of FEVD analysis (Rental price)

Model 1 – Base rate as interest rate

	Ordering I: GDP RPI BR REER					Ordering II: RPI GDP BR REER				
Period	S.E.	DRPI	DGDP	DREER	DBR	S.E.	DRPI	DGDP	DREER	DBR
1	0.150945	99.99383	0.006169	0.000000	0.000000	0.150945	100.0000	0.000000	0.000000	0.000000
2	0.220840	98.03681	1.394919	0.551889	0.016383	0.220840	97.90385	1.527882	0.551889	0.016383
3	0.253625	97.60253	1.115508	0.435307	0.846650	0.253625	97.51853	1.199514	0.435307	0.846650
4	0.268722	94.04762	3.883462	0.974074	1.094845	0.268722	94.04370	3.887384	0.974074	1.094845
5	0.279715	89.31053	8.747635	0.930939	1.010899	0.279715	89.36361	8.694550	0.930939	1.010899
6	0.288486	85.23748	12.53493	1.267974	0.959624	0.288486	85.32440	12.44800	1.267974	0.959624
7	0.295389	81.59531	15.07350	2.368491	0.962695	0.295389	81.69346	14.97535	2.368491	0.962695
8	0.300411	78.89126	16.44198	3.585376	1.081383	0.300411	78.98704	16.34620	3.585376	1.081383
9	0.303515	77.35532	16.79472	4.583979	1.265979	0.303515	77.44577	16.70427	4.583979	1.265979
10	0.305174	76.69604	16.70601	5.205435	1.392519	0.305174	76.78346	16.61858	5.205435	1.392519
	Cholesky ordering: DGDP DRPI DBR DREER					Cholesky ordering: DRPI DGDP DBR DREER				

Model 2 – Mortgage rate as interest rate

Period	Ordering I: GDP RPI MORT REER					Ordering II: RPI GDP MORT REER				
	S.E.	DRPI	DGDP	DREER	DMORT	S.E.	DRPI	DGDP	DREER	DMORT
1	0.150446	99.99519	0.004807	0.000000	0.000000	0.150446	100.0000	0.000000	0.000000	0.000000
2	0.218905	98.09948	1.006067	0.882712	0.011741	0.218905	98.19844	0.907108	0.882712	0.011741
3	0.248930	97.07835	1.020933	0.698430	1.202285	0.248930	97.12239	0.976895	0.698430	1.202285
4	0.266592	91.79632	3.973186	1.391868	2.838628	0.266592	91.76939	4.000112	1.391868	2.838628
5	0.279286	86.69683	8.727145	1.404224	3.171801	0.279286	86.61762	8.806358	1.404224	3.171801
6	0.289140	82.42416	12.88192	1.702281	2.991646	0.289140	82.31299	12.99308	1.702281	2.991646
7	0.296819	78.68786	15.63792	2.754610	2.919614	0.296819	78.56489	15.76089	2.754610	2.919614
8	0.301901	76.09174	16.96088	3.714102	3.233277	0.301901	75.96966	17.08296	3.714102	3.233277
9	0.304945	74.61345	17.25647	4.333077	3.797004	0.304945	74.49585	17.37407	4.333077	3.797004
10	0.306631	73.96588	17.16300	4.611704	4.259416	0.306631	73.85134	17.27754	4.611704	4.259416
	Cholesky ordering: DGDP DRPI DMORT DREER					Cholesky ordering: DRPI DGDP DMORT DREER				

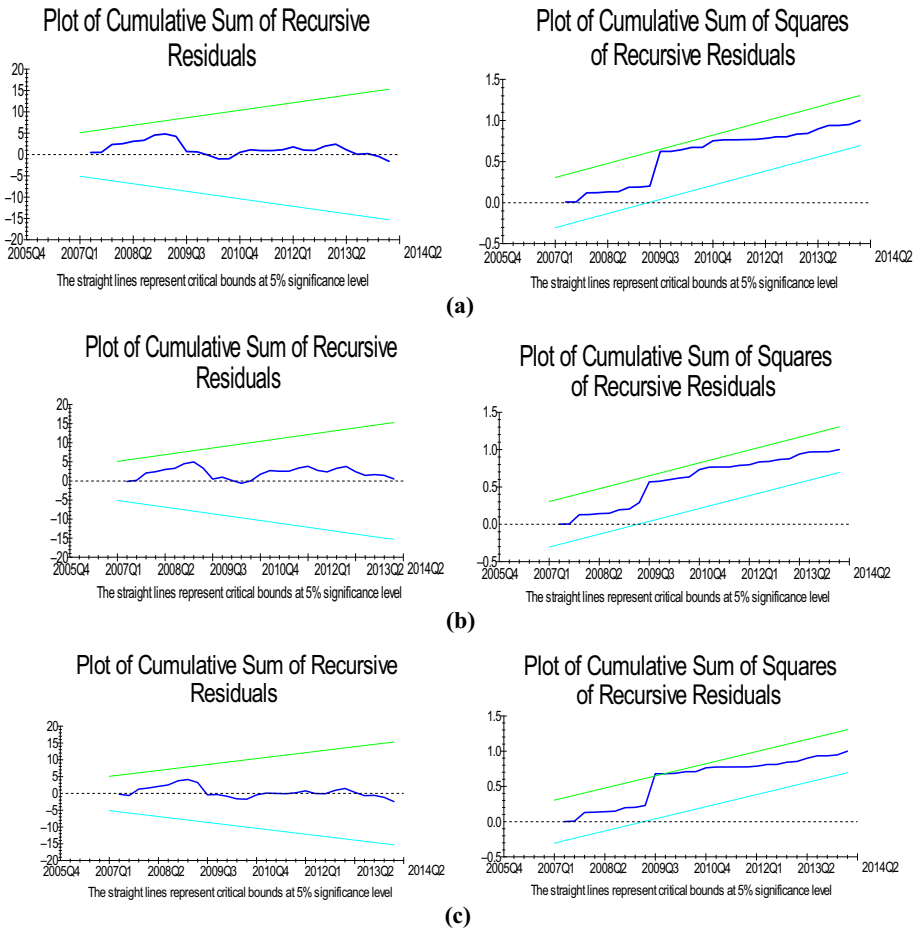
Model 3 – LIBOR as interest rate

Period	Ordering I: GDP RPI LIBOR REER					Ordering II: RPI GDP LIBOR REER				
	S.E.	DRPI	DGDP	DREER	DLIBOR	S.E.	DRPI	DGDP	DREER	DLIBOR
1	0.148499	99.73535	0.264654	0.000000	0.000000	0.148499	100.0000	0.000000	0.000000	0.000000
2	0.212517	98.81802	0.689641	0.049379	0.442959	0.212517	98.27151	1.236155	0.049379	0.442959
3	0.243339	95.49946	0.749954	0.311952	3.438630	0.243339	95.24811	1.001303	0.311952	3.438630
4	0.256963	91.06233	3.908255	1.169680	3.859734	0.256963	91.26149	3.709095	1.169680	3.859734
5	0.269353	85.34509	10.00668	1.134244	3.513981	0.269353	85.94684	9.404932	1.134244	3.513981
6	0.281432	79.88479	15.45695	1.435747	3.222504	0.281432	80.78496	14.55679	1.435747	3.222504
7	0.290981	75.38503	19.01740	2.570648	3.026922	0.290981	76.41530	17.98713	2.570648	3.026922
8	0.297082	72.41420	20.76754	3.874003	2.944251	0.297082	73.45888	19.72287	3.874003	2.944251
9	0.300262	70.89250	21.20365	4.943187	2.960667	0.300262	71.91130	20.18485	4.943187	2.960667
10	0.301686	70.30284	21.09245	5.609491	2.995220	0.301686	71.30352	20.09177	5.609491	2.995220
	Cholesky ordering: DGDP DRPI DLIBOR DREER					Cholesky ordering: DRPI DGDP DLIBOR DREER				

Co-integration hypotheses	*F*-statistics
F(RRI GDP, REER, BR)	2.6710
F(RRI GDP, REER, MORT)	2.3379
F(RRI GDP, REER, LIBOR)	3.2714

Notes: [a] *F*-statistics are below the 10% critical bounds. The relevant critical value bounds are taken from Narayan's (2005) Appendices A1-A3 for Case III: with unrestricted intercept and no trend. We estimate the *F*-statistics for 38 observations by using 35 and 40 number observations with three regressors in the table. Based on 35 observations, relevant critical value bounds at 10% significance level are at 2.958-4.100. On the other hand, based on 40 observations, relevant critical value bounds at 10% significance level are 2.933-4.020

Table VIII. Bound-testing procedure results[a]



Notes: (a) BR model; (b) MORT model; (c) LIBOR model

Figure 4. CUSUM and CUSUMSQ tests

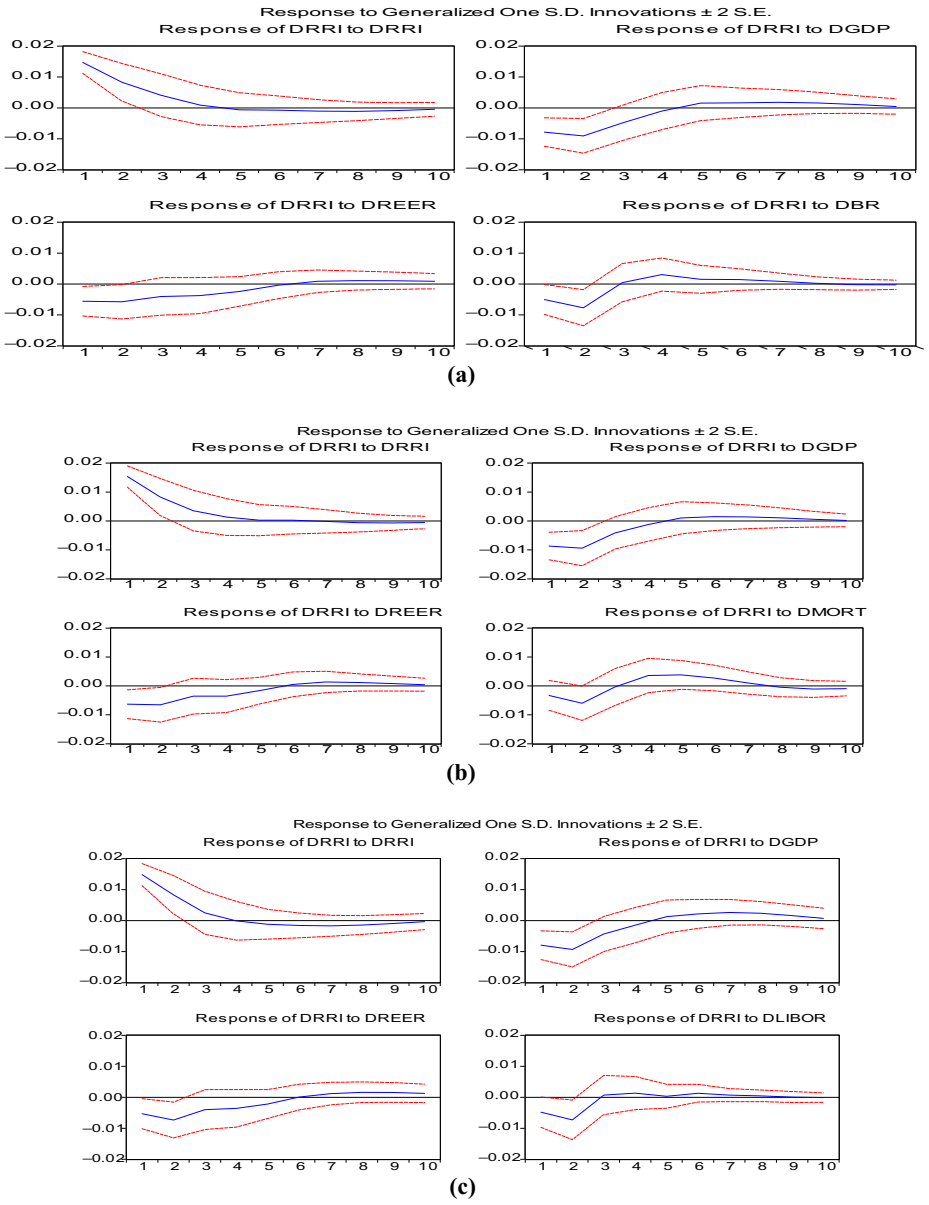


Figure 5.
IRF analysis

Notes: (a) Model 1: BR as interest rate; (b) Model 2: MORT as interest rate; (c) Model 3: LIBOR as interest rate

Table IX. FEVD analysis (RR-I)

Model 1 – Base rate as interest rate

	Ordering I: GDP RRI BR REER					Ordering II: RRI GDP BR REER				
Period	S.E.	DRRI	DGDP	DREER	DBR	S.E.	DRRI	DGDP	DREER	DBR
1	0.01	71.69	28.31	0.00	0.00	0.01	100.00	0.00	0.00	0.00
2	0.02	51.78	43.09	0.16	4.98	0.02	85.87	8.99	0.16	4.98
3	0.02	45.72	43.47	4.57	6.23	0.02	78.82	10.37	4.57	6.23
4	0.02	40.28	38.51	12.36	8.85	0.02	69.56	9.23	12.36	8.85
5	0.02	38.63	37.45	15.18	8.74	0.02	66.78	9.30	15.18	8.74
6	0.02	38.16	37.56	15.44	8.84	0.02	66.09	9.64	15.44	8.84
7	0.02	37.88	37.98	15.35	8.79	0.02	65.83	10.04	15.35	8.79
8	0.02	37.59	38.23	15.42	8.76	0.02	65.57	10.26	15.42	8.76
9	0.02	37.36	38.21	15.61	8.82	0.02	65.28	10.29	15.61	8.82
10	0.02	37.24	38.11	15.81	8.84	0.02	65.08	10.26	15.81	8.84
	Cholesky ordering: DGDP DRRI DBR DREER					Cholesky ordering: DRRI DGDP DBR DREER				

Model 2 – Mortgage Rate as interest rate

Period	Ordering I: GDP RRI MORT REER					Ordering II: RRI GDP MORT REER				
	S.E.	DRRI	DGDP	DREER	DMORT	S.E.	DRRI	DGDP	DREER	DMORT
1	0.02	68.06	31.94	0.00	0.00	0.02	100.00	0.00	0.00	0.00
2	0.02	49.63	47.01	0.59	2.77	0.02	87.11	9.53	0.59	2.77
3	0.02	46.76	48.31	2.09	2.84	0.02	84.43	10.64	2.09	2.84
4	0.02	41.73	43.31	8.22	6.73	0.02	75.51	9.54	8.22	6.73
5	0.02	39.28	40.78	10.60	9.34	0.02	70.67	9.39	10.60	9.34
6	0.02	38.76	40.32	10.44	10.47	0.02	69.08	10.00	10.44	10.47
7	0.02	38.56	40.40	10.56	10.48	0.02	68.48	10.48	10.56	10.48
8	0.02	38.26	40.34	10.84	10.55	0.02	68.03	10.58	10.84	10.55
9	0.02	38.01	40.11	11.03	10.85	0.02	67.60	10.51	11.03	10.85
10	0.02	37.91	39.95	11.09	11.05	0.02	67.38	10.48	11.09	11.05
	Cholesky ordering: DGDP DRRI DMORT DREER					Cholesky ordering: DRRI DGDP DMORT DREER				

(*continued*)

Table IX.

Model 3 – LIBOR as interest rate

	Ordering I: GDP RRI LIBOR REER					Ordering II: RRI GDP LIBOR REER				
Period	S.E.	DRRI	DGDP	DREER	DLIBOR	S.E.	DRRI	DGDP	DREER	DLIBOR
1	0.01	100.00	0.00	0.00	0.00	0.01	71.37	28.63	0.00	0.00
2	0.02	84.39	9.59	4.27	1.74	0.02	50.37	43.62	1.33	4.68
3	0.02	76.59	11.77	5.81	5.83	0.02	44.75	43.61	6.25	5.39
4	0.02	70.70	11.63	8.48	9.19	0.02	41.56	40.77	12.00	5.67
5	0.02	68.91	11.43	10.24	9.42	0.02	40.40	39.94	14.15	5.51
6	0.02	68.41	11.82	10.21	9.56	0.02	39.83	40.40	14.27	5.51
7	0.02	67.91	12.60	10.06	9.42	0.02	39.19	41.32	14.07	5.42
8	0.02	67.30	13.19	10.08	9.43	0.02	38.58	41.90	14.16	5.35
9	0.02	66.72	13.41	10.26	9.62	0.02	38.15	41.98	14.54	5.33
10	0.02	66.33	13.41	10.48	9.78	0.02	37.91	41.83	14.93	5.32
	Cholesky ordering: DRRI DGDP DREER DLIBOR					Cholesky ordering: DGDP DRRI DLIBOR DREER				

rate of the bank than an arbitrary interest rate that is disconnected from the return on real estate market. In profit and loss sharing principles, the bank and the borrower (owner of the house) buy the house together and share the profit (rent). Therefore, charging a rental amount that truly captures what the property would have rented for is the most appropriate way to price home financing. To validate this proposal, using data from the UK housing market for the period 2005-2014, we analysed this rental rate in terms of its resilience to macroeconomic volatilities and found that the rental rate is not significantly susceptible to changes in measures of economic activities, namely, the REER and the GDP, and it is also not determined by three different measures of LRs. This last result is very important, as it shows that our proposed rental rate is not an arbitrary rate of profit indexed on interest rates. This rate being independent from any form of interest rate would be considered more appropriate to be used by Islamic banks because of the non-compliance of contracts that are based on riba.

These findings further suggest that Islamic bankers, even conventional bankers, other industry players like cooperatives providing home loans may consider using RR-I as a benchmark, not only it is more stable and less prone to macroeconomic fluctuations, and at the same time, fairer to both banks and customers as the contract is based on risk sharing mechanism.

Our studies have several limitations. We did not attempt to investigate the impact of the physical attributes of the rental property to formalize the model describing the relationship between them and our rental rate. Also other macroeconomic factors like household income growth, risk, house value growth rate and taxation could be included in future models. Some calculations incorporating our proposed RR-I can also be extended to the pricing of products based on other contracts such as Tawarruq (Commodity Murabahah), and Murabahah for a fairer and just pricing to both the banks and customers.

References

Adegoke, O.J. (2014), "Critical factors determining rental value of residential property in Ibadan metropolis, Nigeria", *Property Management*, Vol. 32 No. 3, pp. 224-240.

Al-Zuhayli, W. (2003), *Islamic Jurisprudence and Its Proofs*, Dar al-Fikr, pp. 33-56.

Asutay, M. (2012), "Conceptualising and locating the social failure of Islamic finance: aspirations of Islamic moral economy vs the realities of Islamic Finance", *Asian and African Area Studies*, Vol. 11 No. 2, pp. 93-113.

Bendjilali, B. and Khan, T. (1995), *Economics of Diminishing Musharakah*, Islamic Research and Training Institute, Islamic Development Bank, Jeddah.

Chow, Y.L., Ong, S.E., Thang, D. and Thang, C.L. (2002), "A cointegration approach to understanding Singapore's industrial space supply", *Journal of Property Investment & Finance*, Vol. 20 No. 2, pp. 96-115.

De Wit, I. and van Djik, R. (2003), "The global determinants of direct office real return", *Journal of Real Estate Finance and Economics*, Vol. 26 No. 1, pp. 27-45.

Dornbush, R. (1985), "Exchange rate and Prices", NBER Working Paper Series, Working Paper No: 1769.

Engle, R.F. and Granger, C.W.J. (1987), "Cointegration and error correction: representation, estimation and testing", *Econometrica*, Vol. 55 No. 2, pp. 251-276.

Fereidouni, H.G. and Bazrafshan, E. (2012), "Determinants of returns on housing: the Iranian case", *International Journal of Housing Markets and Analysis*, Vol. 5 No. 4, pp. 351-360.

Hanna, M.E., Caples, S.C. and Smith, C.A. (2013), "Economic factors impacting the Houston apartment market", *Journal of Economics and Economic Education Research*, Vol. 14 No. 3, pp. 131-138.

Hofmann, B. (2004), "The determinants of bank credit in industrialized countries: do property prices matter?", *International Finance*, Vol. 7 No. 2, pp. 203-234.

Hubbard, R.G. and Mayer, J.C. (2009), "The mortgage market meltdown and house prices, B.E", *Journal of Economic Analysis & Policy*, Vol. 9 No. 3, p. 47.

Hui, E.C.M., Yiu, C.Y. and Yau, Y. (2007), "Retail properties in Hong Kong: a rental analysis", *Property Investment & Finance*, Vol. 25 No. 2, pp. 136-146.

Ibrahim, M.F., Cheng, F.J. and Eng, K.H. (2005), "Automated valuation model: an application to the public housing resale market in Singapore", *Property Management*, Vol. 23 No. 5, pp. 357-373.

Johansen, S. (1991), "Estimation and hypothesis testing of cointegrating vectors in Gaussian vector autoregressive models", *Econometrica*, Vol. 55, pp. 251-276.

Kohlert, D.M. (2010), "The determinants of regional real estate returns in the UK: a Vector error correction approach", *Journal of Property Research*, Vol. 27 No. 1, pp. 87-117.

Koop, G., Pesaran, M.H. and Potter, S.M. (1996), "Impulse response analysis in nonlinear multivariate models", *Journal of Econometrics*, Vol. 74 No. 1, pp. 119-147.

Kuttner, K. and Shim, I. (2012), "Taming the real estate beast: the effects of monetary and macroprudential policies on housing prices and credit", Conference Volume, Reserve Bank Australia, pp. 231-259.

Marco, L. (2007), "Determinants of New York city residential rental prices", *The Michigan Journal of Business*, Vol. 1 No. 1, pp. 61-83.

Matysiak, G. and Tsolacos, S. (2003), "Identifying short-term leading indicators for real estate rental performance", *Journal of Property Investment & Finance*, Vol. 21 No. 3, pp. 212-232.

Meera, A.K.M. and Abdul Razak, D. (2005), "Islamic home financing through Musharakah Mutanaqisah and Al-Bay' Bithaman Ajil contracts: a comparative analysis", *Review of Islamic Economics*, Vol. 9 No. 2, pp. 5-30.

Meera, A.K.M. and Abdul Razak, D. (2009), "Islamic home financing through Musharakah Mutanaqisah and al-Bay'Bithaman Ajil contracts: a comparative analysis", *Review of Islamic Economics*, Vol. 9 No. 2, pp. 5-30

Narayan, P.K. (2005), "The saving and investment nexus for China: evidence from cointegration tests", *Applied Economics*, Vol. 37 No. 17, pp. 1979-1990.

Pesaran, M.H. and Shin, Y. (1998), "Generalized impulse response analysis in linear multivariate models", *Economics Letters*, Vol. 58 No. 1, pp. 17-29.

Pesaran, M.H., Shin, Y. and Smith, R.J. (1996), "Testing for the existence of a long-run relationship", DAE Working Paper, No. 9622, Department of Applied Economics, University of Cambridge, Cambridge, MA.

Pesaran, M.H., Shin, Y. and Smith, R.J. (2001), "Bounds testing approaches to the analysis of level relationships", *Journal of Applied Econometrics*, Vol. 16 No. 3, pp. 289-326.

Smolo, E. and Hassan, M.K. (2011), "The potentials of musharakah mutanaqisah for Islamic housing finance", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 4 No. 3, pp. 237-258.

Usmani, M.T. (2004), *An Introduction To Islamic Finance*, Maktab Maa'rul Quran, Karachi.

White, M., Mackay, D. and Gibb, K. (2000), "A comparative analysis of Scottish property rents", *Journal of Property Investment & Finance*, Vol. 18 No. 3, pp. 332-351.

Yusof, R.M., Kassim, S.H., Majid, M.S.A. and Hamid, Z. (2011), "Determining the viability of rental price to benchmark Islamic home financing products: evidence from Malaysia", *Benchmarking: an International Journal*, Vol. 18 No. 1, pp. 69-85.

Further reading

Ahmad, A.R.Y. (2009), "Role of finance in achieving maqasid al-Shariah", *Islamic Economic Studies*, Vol. 19 No. 2, pp. 1-18.

Ahmed, H. (2011), "Maqasid al-Shariah and Islamic financial products: a framework for assessment", *ISRA International Journal of Islamic finance*, Vol. 3 No. 1, pp. 149-160.

Beck, T., Demirgüç-Kunt, A. and Merrouche, Q. (2013), "Islamic vs. conventional banking: business model, efficiency and stability", *Journal of Banking and Finance*, Vol. 37 No. 2, pp. 433-447.

Bernanke, B.S. and Gertler, M. (1995), "Inside the black box: the credit channel of monetary policy transmission", Working Paper No. 5146, National Bureau of Economic Research, available at: www.nber.org/papers/w5146

Bernanke Ben, S., Gertler, G. and Gilchrist, S. (1999), "Chapter 21: the financial accelerator in a quantitative business cycle framework", *Elsevier, Handbook of Macroeconomics*, Vol. 1, pp. 1341-1393.

Bianco, K.M. (2008), *The Subprime Lending Crisis: Causes and Effects of the Mortgage Meltdown*, CCH, Wolters Kluwer Law & Business.

Brissimis, S.N. and Vlassopoulos, T. (2009), "The interaction between mortgage financing and housing prices in Greece", *The Journal of Real Estate Finance and Economics*, Vol. 39 No. 2, pp. 146-164.

Calza, A., Gartner, C. and Sousa, J. (2001), "Modeling the demand for loans to the private sector in the euro area", *Applied Economics*, Vol. 35 No. 1, pp. 107-117.

Case, B., Pollakowski, H.O. and Wachter, S.M. (1991), "On choosing among house price index methodologies", *Real Estate Economics*, Vol. 19 No. 3, pp. 286-307.

Case, K.E., Quigley, J.M. and Shiller, R.J. (2005), "Comparing wealth effects: the stock market versus the housing market", *Advances in Macroeconomics*, 5 No. 1.

Crotty, J. (2009), Structural causes of the global financial crisis: a critical assessment of the 'new financial architecture', *Cambridge Journal of Economics*, Vol. 33 No. 4, pp. 563-580.

Favilukis, J., Ludvigson, S.C. and Nieuwerburgh, S.V. (2010), "The macroeconomic effects of housing wealth, housing finance, and limited risk-sharing in general equilibrium", NBER Working Papers 15988, National Bureau of Economic Research.

Fitzpatrick, T. and McQuinn, K. (2007), "House prices and mortgage credit: empirical evidence for Ireland", *The Manchester School*, Vol. 75 No. 1, pp. 82-103.

Gerlach, S. and Peng, W. (2005), "Bank lending and property prices in Hong Kong", *Journal of Banking & Finance*, Vol. 29 No. 2, pp. 461-481.

Glenn, R. and Chrisopher, J.M. (2009), "The mortgage market meltdown and house prices", *The B.E. Journal of Economic Analysis & Policy*, Vol. 9 No. 3.

Hasan, M. and Dridi, J. (2010), "The effect of global financial crisis on Islamic and conventional banks: a comparative study", IMF Working Paper, WP/10/201.

Iacoviello, M. (2005), "House prices, borrowing constraints, and monetary policy in the business cycle", *The American Economic Review*, Vol. 95 No. 3, pp. 739-764.

Iacoviello, M.M. and Neri, S. (2008), "Housing market spillovers: evidence from an estimated DSGE model", National Bank of Belgium Working Paper No. 145.

Ibrahim, M.H. (2006), "Stock prices and bank loan dynamics in a developing country: the case of Malaysia", *Journal of Applied Economics*, Vol. 9 No. 1, pp. 71-89.

Jickling, M. (2009), "Causes of the financial crisis", CRS Report for Congress, Congressional Research Service.

Khandani, A.E., Lo Andrew, W. and Merton, R.C. (2013), "Systemic risk and the refinancing ratchet effect", *Journal of Financial Economics*, Vol. 8 No. 1, pp. 29-45.

Kim, S.B. and Moreno, R. (1994), "Stock prices and bank lending behavior in Japan", *Economic Review*, Vol. 1, pp. 31-42.

Kuran, T. (2004), "Why the middle east is economically underdeveloped: historical mechanisms of institutional stagnation", *Journal of Economic Perspectives*, Vol. 18 No. 3, pp. 71-90.

Ling, H.L. and Cha, L.G. (2008), "Inflation and housing market in Shanghai", *Property Management*, Vol. 26 No. 4, pp. 273-288.

McKibbin, W.J. and Stoeckel, A. (2010), "The global financial crisis: causes and consequences", *Asian Economic Papers*, Vol. 9 No. 1, pp. 54-86.

Pesaran, M.H. and Shin, Y. (1999), "An autogressive distributed lag modeling approach to cointegration analysis", in Strom, S., Holly, A. and Diamond, P. (Eds), *Centennial Volume of Ragnar Frisch*, Cambridge University Press, Cambridge, MA.

Schularick, M. and Taylor, A.M. (2009), *Credit Booms Gone Bust: Monetary Policy, Leverage Cycles and Financial Crises, 1870-2008*, National Bureau of Economic Research.

Shanmugam, B. and Zahari, Z.R. (2009), *A Primer on Islamic Finance*, The Research Foundation of CFA Institute.

Sims, C. (1980), "Macroeconomics and reality", *Econometrica*, Vol. 48, pp. 1-48.

Tse, R.Y.C. (1997), "Optimal loan size and mortgage rationing", *Journal of Property Finance*, Vol. 8 No. 3, pp. 195-206.

Vargas-silva, C. (2008), "Monetary policy and the US housing market: a VAR analysis imposing sign restrictions", *Journal of Macroeconomics*, Vol. 30 No. 3, pp. 977-990.

Yusof, R.M. and Hassan, F.U. (2015), "Islamic home financing and the real sectors in Malaysia: an ARDL bound testing approach to cointegration", *International Journal of Economics, Management & Accounting*, Vol. 23 No. 1, pp. 79-107.

Corresponding author
Rosylin Mohd Yusof can be contacted at: rosylin@uum.edu.my