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House Prices and Islamic Bank Stability in Indonesia: Evidence from Autoregressive Distributed Lag (ARDL) Model

(Harga Rumah dan Kestabilan Bank Islam di Indonesia: Bukti dari Model Autoregressive Distributed Lag (ARDL))

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ABSTRACT

This study examines the effect of house prices on Islamic bank stability in the long run and their short run dynamic interactions with real output and interest rate for the case of Indonesia. As bank risks may response differently to the shock of house prices, the aggregate and disaggregate house price indices, namely, small house price indices, medium house price indices and large house price indices, are applied in the analysis. By employing autoregressive distribution lag (ARDL) test for co-integration, we find the presence of long run relationship between house prices, Islamic bank risk and macroeconomic variables. A long run relationship is also found for the medium and large-house prices' indices. The estimated long run coefficient is found to be supportive to the deviation hypothesis. Furthermore, results from the impulse response functions (IRFs) and error correction mechanism (ECM) reflect the short run dynamic interactions between house prices and bank credit. The results from disaggregate analysis reveal that only small-house prices have the relationship with Islamic bank risk, and interestingly, the results support the deviations hypothesis. Our findings have important implications for bankers, monetary authority and investors in determining policy and business decisions especially in stabilizing house price for low income earners.

Keywords: House prices; Islamic bank risk; NPF; Co-integration; ARDL

ABSTRAK

Kajian ini mengkaji kesan harga rumah ke atas kestabilan Bank Islam dalam jangka masa panjang dan interaksi dinamik jangka masa pendek dengan output benar dan kadar bunga untuk kes Indonesia. Oleh kerana risiko bank mungkin memberi tindak balas yang berbeza terhadap kejutan harga rumah, indeks harga rumah agregat dan bukan agregat iaitu indeks harga rumah kecil, indeks harga rumah sederhana dan indeks harga rumah yang besar, digunakan di dalam analisis ini. Dengan menggunakan ujian autoregressive distribution lag (ARDL) untuk kointegrasi, kami mendapati kehadiran hubungan jangka panjang di antara harga rumah, risiko bank Islam dan pembolehubah makroekonomi. Hubungan jangka panjang turut dijumpai untuk indeks harga rumah sederhana dan besar. Penganggaran pekali jangka masa panjang didapati menyokong hipotesis sisihan. Selanjutnya, keputusan daripada fungsi tindak balas impuls (IRF) dan mekanisme pembetulan ralat (ECM) mencerminkan interaksi dinamik jangka pendek antara harga rumah dan kredit bank. Hasil daripada analisis bukan agregat menunjukkan bahawa hanya harga rumah kecil mempunyai hubungan dengan risiko bank Islam, dan yang menariknya, hasilnya menyokong hipotesis sisihan. Hasil kajian ini mempunyai implikasi yang penting kepada pengurusa bank, pihak berkuasa kewangan dan pelabur dalam menentukan polisi dan keputusan perniagaan terutamanya dalam menstabilkan harga rumah bagi golongan berpendapatan rendah.

Kata kunci: Kedai rumah; risiko Bank Islam; NPF; kointegrasi; ARDL

INTRODUCTION

The relationships of house price, credit and default risk have gained attention by many. Research had not only been done in developed countries such as Tajik et al. (2015), Pan and Wang (2013), Koetter and Poghosyan (2010) and Marcucci and Quagliariello (2009), but also in developing countries such as Zhu (2006), Inoguchi (2011) and Ibrahim and Law (2014) to name a few. These relationships can be explained in both directions. If the bank lowers the price of credit, we would expect an increase in economic activities as loan demand increases. On the other hand, if housing price increases, it induces banks to lend more and thus improves the bank balance sheet (Ibrahim & Law 2014). However, if house price increases very significantly, it exposes bank credit to defaults. Due to this, banks may reduce their loans. Meanwhile, taking income into account, an increase in general income or wealth, despite increase in house price, the loan demand is expected to increase as well. Therefore, these two-way relationships require more empirical studies.

The investigation of relationship between housing price and credit behavior is important since it contains valuable information. For example, significant increase in the housing price in Indonesia is due significant increase in housing demand and regulation that slows down the supply side. As reported by Second Quarter of Residential Property Price Survey (2010), an official document by Bank Indonesia, it states that the demand for residential property had increased by 15.8%. This might be contributed by the growing numbers of middleclass and affluent consumers (MAC); in which as many as 74 million out of 260 million, a total population in Indonesia (BCG 2013),who certainly need places to live.

Hence, the policy makers have to take the above examples into account in their formulation of price stabilization policy such as Loan to Value (LTV). Moreover, those policies shall accommodate the prevailing policy on the credit channel of monetary transmission. This is important as it provides us with the insight into the policy rate to the real sectors. Besides policy makers, the knowledge of housing price with regard to credit market is also important to the investors and construction firms. This is because the economic multiplier effect, especially from construction firms, is significant. For example, labor absorption which lowers unemployment rate and the number of relevant companies which will certainly increase the overall productivity. Hence, these are all the concerns of the policy makers; and in this case monetary authority which looks into banking performance, including Islamic banks.

Islamic banks are getting more attention particularly after the Asian financial crisis in 1998 and the US subprime mortgage. This is because Islamic banks were relatively stable when many conventional banks deteriorated during those periods (Smolo & Mirakhor 2010; Hasan & Dridi 2011; Ibrahim 2016). One of the features that makes the Islamic bank resilient is that Islamic bank is based on real sectors whereby derivative instrument applied in conventional banking cannot be accepted in Islam. Another feature is that, in Islamic bank various contracts are offered; which differs from that of conventional banks which is only loan. Those various contracts in Islamic banks have the characteristics that provide resilience when exposed to crisis. Several empirical studies have documented supportive results to the stability view of Islamic bank and these include Cihak and Hesse (2010), Hasan and Dridi (2010), Beck, Demirguc-Kunt and Merrouche (2013), Belaness et al. (2015) and most recently Ibrahim (2016). On the other hand, there are also empirical studies that documented no differential and even less stability in Islamic bank (i.e. Bourkhis & Nabi 2013; Beck et al., 2013; Daher, Masih & Ibrahim 2015). Other studies with regard to the Islamic bank can also be seen in Nor (2015), and Sukmana and Febriyati (2016) which could add further explanation on this issue.

Few studies have attempted to look at the relationship between Islamic bank and macroeconomic variables such as Waemustafa and Sukri (2015), Saev and Masih (2017), Yusof et al. (2011). They focus on factors propelling Islamic banks' non performing financing. However, as for the focus on Islamic banks' risk, no assessment has been made on how non-performing financing and house prices interact. In light of these, this paper empirically examines the effect of house prices on financing risk of Islamic bank for the case of Indonesia. More specifically this research brings three essential objectives. First, this paper investigates whether house prices in Indonesia share long run relationship with financing risk of Islamic bank. If there is a long run relationship, we are interested to observe the nature of this relationship. Second, this paper examines the nature of short term dynamic relationship between house prices and Islamic bank risk. Third, are there possibilities that the responses of nonperforming financing (NPFs) of Islamic bank to the change in house prices varied if we estimate at various levels of income; here we employ aggregate and specific type of houses, namely, small, medium and large houses' prices, to analyze the house price's segment that drives and driven by Islamic bank financing risk. The choice of Indonesia is straight forward. Firstly, Indonesia is the largest Muslim population; hence, it is interesting to look into their contribution to the Islamic bank. Secondly, based on the relevant information, the increase in housing price is significant; data show that the annual increase of housing price is at around 34.33 % (Bank Indonesia 2013). Moreover, a survey conducted by Bank Indonesian in 2017 showed that most of the consumers (75.93%) opted for housing loans to purchase residential property, while developers used 43.82% of bank funds to finance their property development projects. It is certainly interesting to look at the default rate's performance of Islamic banks in Indonesia with regard to house prices' fluctuations.

The rest of the paper is structured as follows; the next section is a brief review of the relevant literature. Section 3 describes the data and empirical approach. Section 4 presents and discusses the estimation results. The last section, contains summary the main findings and concluding remarks.

EMPIRICAL LITERATURE

Credit risk analysis is an important issue in the banking management and economic stability, and, therefore, numerous studies have empirically examined the credit risk. The main strand of previous studies hypothesizes that credit risk is highly related to business cycles; these include Pesola (2001), Salas and Saurina (2002), Meyes and Yeager (2001), Gambera (2002), Bikker and Hu (2002), Leaven and Majoni (2003), Valckx (2002), Koopman and Lcas (2005), Pesaran et al. (2006), Quagliariello (2007), Marcucci and Quagliariello (2008) and Hoggarth Sorensen and Zicchino (2005). The conclusions of these studies show that business cycles could play significantly important roles in explaining banks' risk.

In relation to business cycle, banks' risk exposure is likely to be affected by housing cycle. Theoretical arguments that explain the relationship between house prices and bank risk can be classified into two competing theories, namely, the collateral value hypothesis (Daglish 2009; Ninimaki 2009) and the deviation hypothesis (Von Peter 2009; Gerlach & Peng 2005). Daglish (2009) argued that real estate price appreciation discourages sub-prime mortgage borrowers from defaulting. Hence, increase in property prices should decrease the risk of bank's assets, and reduce the probability of distress (Ninimaki 2009). The collateral value hypothesis argues that increase in property prices will enhance bank stability, thus they predict that property prices to be negatively related to riskiness of the bank.

In contrast, the proponent of deviations hypothesis argues that, increase in house prices enhances the accumulations of banks' risk due to moral hazards and adverse selection problems (Bernanke & Gertler 1995; Allen & Gale 2001). As increase in house prices will lower the perceived risk of real estate financing, this condition will induce excessive lending to risky borrowers at low rates. Increase in house prices will encourage risky borrowers to bet on further price increase and demand credit from banks. Thus, deviation hypothesis argues that increase in house prices has positive relationship with banks' risk.

Studies on the relationship between house prices and bank stability are mostly conducted on conventional banks. Daglish (2009) evaluated the combination of house prices and interest rates that triggers a household's default and the situation of the household that leads to default by using U.S data. He found that the level of house prices which will trigger default depends critically on the prevailing interest rate. Meanwhile, Niimaki (2009) presented models in which the fluctuations in real estate prices generate moral hazard problem between a bank and a deposit insurance agent. The bank finances risky projects against collateral and relies on the rising collateral value. Garlah and Peng (2005) examined the relationship between house prices and bank lending for the case of Hong Kong. They found a long run relationship between house prices and bank lending. Kotter and Poghosyan (2010) tested the relationship between real estate prices and individual banks in Germany for the period of 1995-2004. They found that house prices' deviations affect bank stability. Most recently, Pang and Wang (2013) examined the effects of house prices on bank stability based on the various levels of income growth by employing 286 U.S. Metropolitan Statistical Area spanning from 1990 to 2010. They found the existence of income growth threshold effects in the relationship between house prices and bank stability.

Islamic banks experienced significant growth since the turn of 21st century mainly in Middle East and Southeast Asia and have increasing acceptance in non-Muslims countries (Ibrahim 2016). The prevailing view among Islamic bankers and scholar in Islamic banking and finance is that Islamic banks are likely to be more stable and resilient to external shocks since it has different characteristics from the conventional banking system. As argued by Farooq and Zaheer (2015) there are several features of Islamic banking that may protect itfrom external shocks, namely, the prohibition of interest, speculative activities and of excessive risk-taking and its fundamental links between banks and real sectors.

Several studies have empirically supported the "stability" views of Islamic banks (e.g., Ibrahim 2016; Cihak & Hesse 2010; Hasan & Dridi 2010; Beck et al. 2013; Belanes et al. 2015; Farooq & Zaheer 2015).Based on the individual data of Islamic and commercial banks in 19 countries, Cihak and Hesse (2010) found Islamic banks tend to be more stable than small commercial banks; however, large commercial banks tend to be more stable than large Islamic banks. Hasan and Dridi (2010) examined the performance of Islamic and conventional banks during 2008 global financial crisis in 8 countries. They found that for some indicators, Islamic banks performed better than conventional bank during the crisis. Beck et al. (2013) evaluated the differences between Islamic and conventional banks in terms of business orientation, efficiency, asset quality, and stability across countries. They found Islamic banks to be less efficient but performed better in terms of intermediation ratios, asset quality, and capitalization than conventional banks during normal and crisis periods.

The above empirical studies on Islamic bank focus on the factors that propel Islamic banks' non-performing financing. However, in terms of Islamic banks' risk, no assessment has been made on how non-performing financing and house prices interact. Several empirical studies have documented significant relationship between housing market and banks' credit in the context of conventional bank. As Islamic banks are perceived to have different characteristics from conventional bank, examining housing market effect on Islamic bank credit will provide further insight into the housing-bank relationships. This paper complements the existing literature by looking specifically at the case of Islamic bank using post Asian crisis data.

DATA AND EMPIRICAL APPROACH

DATA

This study employs quarterly data spanning from 2002Q1 to 2015Q4, the period of which is dictated by data availability. The span of our data coverage is justified by the fact that many studies examined similar period. Among the studies are Ibrahim and Law (2014) for Malaysia using quarterly data from 1999Q1 to 2011Q4, Hepsen and Vatansever (2012) for Dubai market employing monthly data from 2003 to 2010, Mallick and Mahalik (2012) for the case of China using quarterly data from 1999 to 2009, and Liang and Chao (2007) for China using quarterly data

spanning from 1999 to 2006. Therefore, based on prior studies we believe that the 14 years period is justifiable to capture the long term relationship while cautioning the readers about the data limitation.

This study obtains the quarterly data of the Indonesian Property Price Index from Bank of Indonesia's official website. Apart from aggregate house price (HT) index, Bank Indonesia also publishes three sub-indices based on various types of house, namely: small house (HS), medium house (HM) and large house (HL). To gain comprehensive results, we consider all these types of houses in our analysis. To measure real income (Y) we use real GDP, while for Islamic bank risk we adopt the ratio of non-performing financing to total financing held by aggregate Islamic bank (NPF). Finally we employ short term money market (Jakarta interbank Overnight Rate (JIBOR) 3-month rate as the measure of interest rate. All the data are retrieved from Bank Indonesia's official website. GDP and House Price are transformed into the natural logarithm.

EMPIRICAL APPROACH

To examine the long-run relationship among house prices, bank risk, real output and interest rate, we employ the Autoregressive Distribution Lag (ARDL) bound testing approach to co-integration. This approach was introduced by Pesaran, Shin and Smith (1996). The choice of the ARDL approach in this study is based on the consideration that co-integration analysis is unbiased and efficient. The ARDL approach has several advantages. According to Pesaran, Shin and Smith (2001) this technique provides robust results for a smaller sample size of co-integration analysis. As this study employs small sample due to data availability, this provides additional motive for adopting this approach in this study. Another advantage of employing ARDL approach is that the model takes sufficient number of lags to capture the data generating process from a general to specific modeling framework (Laurenceson & Chai 2003). This model estimates $(p + 1)^k$ number of regression to gain optimal lag-length for each variable, where p is the maximum lag to be used and k is the number of variables in the model (Majid & Yusof 2009). Model selection criteria namely; R-Bar Square, Akaike information criteria (AIC), Schwartz-Bayesian Criteria (SBC) and Hanan and Quin (HQ) will be used to select the optimum model resulted from ARDL approach. Moreover, this approach also estimates the short and long run components of the model simultaneously, removing problems associated with omitted variables and autocorrelation. We examine the long and short run relationships of house prices, non performing financing of Islamic bank industry and other macro variables (GDP and interest rate). GDP is chosen since this represents the overall economic activities and interest rate is utilized since it is directly related to the financing default risk. Hence, this is the model:

$$NPF_t = \beta_0 + \beta_1 H_t + \beta_2 Y_t + \beta_3 R_t + \varepsilon_t \quad (1)$$

Where NPF_t aggregate nonperforming financing of Islamic bank industry is, H_t is house prices[1], Y_t is Gross Domestic Product, and R_t is interest rate.

Moreover, a dynamic error correction model (ECM) will be derived from ARDL model in equation (1). The ECM integrates the short run with long run equilibrium, without losing long run information (Majid & Yusof 2009). The error correction versions of the ARDL framework concerning Equation (1) can be reformulated as follows:

$$\Delta NPF_t = \alpha_0 + \sum_{j=1}^{k1} \beta_j \Delta NPF_{t-j} + \sum_{j=0}^{k2} \gamma_j \Delta H_{t-j} + \sum_{j=0}^{k3} \delta_j \Delta Y_{t-j} + \sum_{j=0}^{k4} \theta_j \Delta R_{t-j} + n_1 NPF_{t-1} + n_2 H_{t-1} + n_3 Y_{t-1} + n_1 R_{t-1} + \varepsilon_t \quad (2)$$

Based on Equation 2, the dynamics of error correction representing by part with summation symbol, while parts with n_s corresponds to the long term relationship. The test statistics are developed to test the null hypothesis (H_0: $n_1 = n_2 = n_3 = n_4 = 0$) of absence of the long run relationship against alternative hypothesis of the existence of a long run relationship, by comparing F test with its critical value. However, the asymptotic distribution of F-statistic resulted from this model is nonstandard regardless of whether the variable is I(0) or I(1). Narayan (2005) had tabulated sets of appropriate critical values. If the F-statistic lies above the upper bound level, the null hypothesis is rejected, indicating the existence of long run relationship among the variables. Moreover, if the F-statistic falls below the lower bound, then the null hypothesis cannot be rejected; if the F-statistic falls within lower and upper bounds, the result is inconclusive (Kasim 2013). If co-integration exists, then the analysis is continued by estimating the coefficient of long run relationship of house prices, bank risk and other macro variables based on selected ARDL models. The final step is estimating the associated ARDL ECMs which look into short run relationship; and this is continued by the structural stability test to ascertain the goodness of fit of the selected model by using cumulative sum of recursive residual (CUSUM) and the cumulative sum square of recursive residuals (CUSUMSQ).

Apart from the above model, we are also interested in the dynamic relationship among the variables. To this end, this study will generate impulse-response functions (IRFs) based on Vector Autoregressive (VAR) system. IRFs results enable us to assess the direction, magnitude and persistence of one variable to the shocks of other variables in the system.

RESULTS

Table 1 reports the summary statistic of the variables used in this analysis. For each variable, its mean, median, and standard deviation, are reported. It appears that, on average 3.77% of aggregate financing held by Islamic banks are nonperforming financings. Moreover, the average change

in aggregate house prices (HT) is lower than average growth in GDP (Y), but house prices have relatively low volatility as compared to GDP growth. If we observe average price growth among the three types of houses, small house has the highest average price growth (1.63%) followed by medium house (1.36%) and large house (1.14%). Despite having the smallest price growth rate, large-house price exhibits the highest volatility among other types of houses.

TABEL 1. Descriptive statistics

	NPF	ΔHT	ΔHS	ΔHM	ΔHL	R	ΔY
Mean	0.0377	0.0145	0.0163	0.0136	0.0114	8.5593	0.0347
Median	0.0390	0.0117	0.0136	0.0102	0.0087	8.0100	0.0464
Maximum	0.0663	0.0471	0.0827	0.0738	0.1678	15.9800	0.0999
Minimum	0.0222	0.0033	0.0027	-0.0513	-0.1142	4.2100	-0.0282
Std. Dev.	0.0100	0.0100	0.0130	0.0167	0.0286	2.7218	0.0324

Notes: NPF is non performing financing HT is aggregate house price index, HS is small house priceindex, HM is medium house price index, HL large house price index, R is money market rate, Y is real GDP.

Table 2 provides simple correlation to describe the short run relationships among variables being studied. The results show that aggregate house prices are relatively highly correlated with all types of houses. Specifically, prices for small house have the highest correlation with aggregate house price index, followed by medium and large houses, respectively. Moreover, the correlations between non performing financing and all houses' price indexes are negative. Interestingly, among the disaggregate house prices only small house has significant and negative correlation with financing risk of Islamic bank. In general, property prices have negative relationship with NPF and this is consistent with the collateral value hypothesis which says that increase in property price leads to bank stability. Interest rate is positively correlated with non performing financing. Increase in interest rate leads to the increase in financing default risk. Interestingly, the correlation between interest rate differs among type of houses, interest rate has positive correlation with aggregate house price index and large house, and is negatively correlated with small and medium houses. These results may indicate the difference in the characteristics between large and small houses' buyers.

TABEL 2. Correlations

	NPF	DHT	DHS	DHM	DHL	DY	R
NPF	1						
DHT	-0.3489***	1					
DHS	-0.2925**	0.8629***	1				
DHM	-0.2035	0.6112***	0.4045***	1			
DHL	-0.0717	0.4736***	0.6453***	-0.0760	1		
DY	0.2962**	-0.0848	-0.0509	0.0059	-0.0840	1	
R	0.3472***	0.1264	-0.0038	-0.0241	0.0242	0.07662	1

Notes: *, ** and *** denote significance levels at 10 percent, 5 percent and 1 percent, respectively.

Before analyzing the relationship between house prices and Islamic banks' risk, a priori analysis on the properties of the time series data is performed. Table 3 reports the results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. From the table, it is observed that the variables are non-stationary at levels except for interest rate. Interest rate is found to be stationary in level based on ADF test. Meanwhile, their first difference form is stationary I (1). According to Pesaran et al. (1996) the ARDL approach can be applied regardless of the stationary properties of the variables in the samples and allows for inference of long-run estimates. Below, we proceed to cointegration test based on ARDL bound testing procedure.

According to Majid and Yusof (2009) in the process of testing the long run relationship (co-integration) it is crucial to set the order of lags since the results of this step are sensitive to the order of VAR. In this study, we impose lag orders of 1-4 on the first difference of all variables and compute the F-statistic for the joint significance of lagged levels of variables. Table 4 presents the ARDL co-integration test results for four systems, namely: aggregate house price system, small house price system, medium house price system and large house price system. From

TABEL 3. Unit root test

	Level		First difference	
	ADF	PP	ADF	PP
NPF	-3.0452	-3.0006	-10.4203***	-10.4240***
HT	-0.9807	-0.9823	-4.2087***	-4.2753***
HS	-0.0743	-0.0655	-4.8634***	-4.8502***
HM	-0.6118	-0.6118	-7.7975***	-7.7982***
HL	-1.1947	-1.0994	-7.9385***	-12.1701***
Y	-2.0585	-2.2746	-1.9722	-7.9058***
R	-3.6139**	-2.8437	-4.4451***	-4.2244***

Notes: *, ** and *** denote significance levels at 10 percent, 5 percent and 1 percent, respectively.

the aggregate system we may infer that the null hypothesis of no existence of long run relationship is rejected at 5% level of significant; indicating that aggregate house prices, nonperforming financing, real output and interest rate co-integrate in the long run. For the case of medium-house prices and large-house prices, the null hypothesis of no co-integration is also rejected at 5% significance level based on critical value developed by Narayan (2005). Interestingly, for the case of small house model, the null hypothesis of no co-integration cannot be rejected. Thus, indicating that there is no long run relationship between small-house prices, bank risk and macro variables.

TABEL 4. ARDLF-statistics for testing the existence of Co-integration

Order of lag	Model 1 Aggregate	Model 2 Small	Model 3 Medium	Model 4 Large
1	2.7219	2.5294	2.5946	3.1956
2	3.2064	1.4693	2.1946	2.6254
3	1.7442	1.4693	1.3319	1.5026
4	3.6959**	3.1307	4.1414**	4.4327**

Notes: The relevant critical value bounds are taken from Narayan (2005) with a restricted intercept and no trend; number of regressors = 3). They are 4.068-5.250 at 99 percent significance level, 2.962-3.910at 95 percent significance level and 2.496-3.346 at 90 percent significance level. ** and *** denote that F-statistics fall above the 95 percent and 99 percent upper bound, respectively.

Having established long run co-movement among the variables based on the results of ARDL bound testing approach, we then obtained the estimated long run equations for the aggregate, medium and large house price indices' model. The long run ARDL model is selected based on R-BAR squared, AIC, SBC and HQ criteria and is reported in Table 5. In general, Table 5 of aggregate house price model indicates that all variables are found to have significant effect on Islamic bank risk as measured by non performing financing. Aggregate house prices have positive impact on Islamic bank risk. These results support the argument of deviations hypothesis, i.e. rising housing price will increase exposure and the accumulation of risky assets of the banks. This is because as asset price increases, banks will be more excessive in their financing to risky borrowers at lower rate. Furthermore, as asset price increases, demand for financing from Islamic bank by risky borrower will increase and further raises the house prices. While the long run relationship between aggregate house price and Islamic bank risk is found to be positive and significant, we find no evidence of significant relationship between medium and large houses' prices and Islamic bank risk. This result contradicts the evidence found by Tajik et al. (2015) and Pang and Wan (2013) for the case of U.S banks. The estimated coefficients of aggregate house prices indicate that for 10% increase in house price, there is an increase in nonperforming financing by around 2%. Meanwhile for every 10% increase in real output, there is a decline in Islamic banks' risk by around 10%. Interest rate has positive relationship with nonperforming financing, where a 10% increase in interest rate is followed by around 0.1% increase in nonperforming financing. This is as expected since interest rate is still the benchmark for Islamic banks in determining their rate of returns. The finding seems to be consistent with the finding of studies conducted by Rosly (1999), Kassim, Majid and Yusof (2009), and Sukmana and Kasim (2010).

On the basis of co-integration results, we estimate error correction models (ECM) to examine the existence of error correction mechanism as well as short run relationship between house prices and Islamic banks' risks as well as other macro variables. Table 6 provides the results of the error correction model representation of ARDL model. The results from disaggregate house price system indicate that non performing financing of Islamic banks is only sensitive to the changes in small-house prices, while changes in medium and large houses' prices have no impact on the nonperforming financing of Islamic bank. As house type may represent the income level of the buyers, this result indicates that only small house seems to be the driver of the change to Islamic bank stability. This is justified as the people who buy small houses are commonly those who earn less income as compared to that of those who buy medium or large houses. These results support the results of Pang and Wang (2013) who found that different income growth level affects the relationship between house prices. Furthermore, results from aggregate house model verify the collateral value hypothesis. Hence, suggesting that in the short run, the higher the change in house prices, the lower the bank instability; which argues that increase in house price will increase banks' credit risk. As such suggesting a negative relationship between house prices and NPF of Islamic bank.

Moreover, from the disaggregate perspective, the relationship between interest rate and NPF of Islamic bank seems to have consistent results. As we can see in Table 6, the magnitude of interest rate to the NPF in small-house system is bigger than those of medium and large houses' systems. This indicates that by nature, small-house system tends to have bigger impact on Islamic banks' stability. As for other macroeconomic variables, real output change

TABLE 5. Estimated long run coefficients using the ARDL approach

Regressors	R-BAR Squared	AIC	SBC	HQ
Aggregate house prices	(3,3,1,4)	(3,3,2,2)	(1,1,1,1)	(3,3,1,2)
HT	0.2446**	0.2322**	0.2227**	0.2166**
	(2.362)	(2.2748)	(2.4219)	(2.1228)
Y	-0.0893***	-0.1286***	-0.1046***	-0.0951***
	(-3.1945)	(-3.3548)	(-3.7174)	(-3.4396)
R	-0.0015	0.0018*	0.0019**	0.0019*
	(-1.6882)	(1.8277)	(2.4617)	(1.9892)
C	-0.1174**	-0.1028*	-0.1294**	-0.1028*
	(-2.6826)	(-1.9972)	(-2.1439)	(-1.9972)
DW-statistic	2.0200	2.0684	1.9505	1.9575
Medium house prices	(3,0,1,2)	(3,0,1,2)	(1,0,1,2)	(1,0,1,2)
HM	-0.0033	-0.0033	0.0012	0.0012
	(-0.1876)	(-0.1876)	(0.0644)	(0.0644)
Y	-0.0983***	-0.0983***	-0.1048***	-0.1048***
	(-3.3822)	(-3.3822)	(-3.6134)	(-3.6134)
R	0.0026**	0.0026**	0.0024**	0.0024**
	(2.6185)	(2.6185)	(2.3422)	(2.3422)
C	-0.0734**	-0.0734**	-0.0788**	-0.0788**
	(-2.3431)	(-2.3431)	(-2.4773)	(-2.4773)
DW-statistic	2.0390	2.0390	2.1535	2.1535
Large house prices	(1,0,3,2)	(1,0,3,2)	(1,0,1,2)	(1,0,1,2)
HL	0.0302	0.0302	0.0180	0.0180
	(1.3585)	(1.3585)	(0.8443)	(0.8443)
Y	-0.0657**	-0.0657**	-0.1090***	-0.1090***
	(-2.1397)	(-2.1397)	(-3.8246)	(-3.8246)
R	0.0029***	0.0029***	0.0023**	0.0023**
	(2.8117)	(2.8117)	(2.2677)	(2.2677)
C	-0.2592***	-0.2612**	-0.1907**	-0.2612**
	(-5.8726)	(-2.6194)	(-2.1398)	(-2.6194)
DW-statistic	2.1000	2.1000	2.1757	2.1757

Notes: Figures inside the parentheses are the value of t-ratios; *, ** and *** denote significance levels at 10 percent, 5 percent and 1 percent, respectively.

has positive and significant effect on Islamic banks' risk in the short run. Moreover, we find consistent negative and significant error correction terms which suggests the existence of correction mechanism to return to the long term equilibrium.

Figure 1 presents the graphical representation of CUSUM and CUSUMQ plots. Both CUSUM and CUSUMQ provide the evidence of structural stability for the model we have tested. Results from Durbin-Watson statistics also indicate that we fail to reject the existence of autocorrelation for the models tested.

The generalized impulse response functions (IRFs) are plotted in Figure 2. From the aggregate house prices system, similar to co-integration results we show that NPF has positive responses to the innovations in house prices. We note that NPF seems to have no significant response to the shock in real output and interest rate. Figure 2 also presents IRFs plotted figure for small-house price system. The results seem to be consistent with the aggregate prices results, we find positive response of NPF to the innovations in small house prices. We also note that there are no significant responses from NPF to the innovations in real output and interest rate. Interestingly, we find no significant response of NPF to the innovations from medium house prices and large house prices' systems. The results from IRFs seem to be consistent with ECM results which indicate that NPF of Islamic banks tends to be more sensitive to the shocks in small-house prices than to other house types, i.e. medium and large houses. These results support the previous study done by Pan and Wang (2013). Their study, based on U.S data, revealed the existence of income threshold effects in the relationship between house prices and bank stability. In general, results from IRFs seem to support the deviation hypothesis in the literature. It suggests that the rising of house prices will cause larger exposure and the accumulation of risky asset in the bank's balance sheet. If the asset price increases, the bank will be more excessive in its financing.

Our findings have important implications to academicians and bankers and policy makers. Therefore,

TABLE 6. Error correction representation of ARDL model selected based on Akaike Information Criterion (AIC)[2]

Regessors	House price			
	Aggregate	Small	Medium	Large
ΔNPF_{t-1}	0.1792	-0.0334	-0.0325	-
	(0.1292)	(-0.2492)	(-0.2423)	
ΔNPF_{t-2}	0.2691**	0.2090*	(0.2107*)	-
	(2.3118)	(1.7328)	(1.7340)	
ΔH_t	-0.27988***	-0.0021	-0.0033	0.0302
	(-2.8153)	(-0.1508)	(-0.1876)	(1.3585)
ΔH_{t-1}	0.1752	-	-	-
	(1.6177)			
ΔH_{t-2}	-0.2322**	-	-	-
	(-2.2748)			
ΔY_t	0.0861***	0.1045***	0.1046***	0.1275***
	(3.1509)	(3.6437)	(3.6449)	(4.2939)
$\Delta Y1_{t-1}$	-0.0406	-	-	0.0216
	(-1.2533)			(0.6429)
$\Delta Y1_{t-2}$	-	-	-	0.0657**
				(2.1397)
ΔR_t	0.0005	0.0006	0.0006	-0.0001
	(0.5543)	(0.6470)	(0.6570)	(-0.0117)
ΔR_{t-1}	-0.0017*	-0.0026**	-0.0026**	-0.0029***
	(-1.8277)	(-2.5838)	(-2.6185)	(-2.8117)
ecm(-1)	-0.5542***	-0.4791***	-0.4799***	-0.4917***
	(-4.6395)	(-4.4394)	(-4.4657)	(-4.8675)
R-Squared	0.6139	0.5382	0.5384	0.5482
DW-statistics	2.0684	2.0387	2.0390	2.1000

Notes: Dependent variable is ΔNPF, Figures inside the parentheses are the value of t-ratios; *, ** and *** denotesignificance levels at 10 percent, 5 percent and 1 percent, respectively

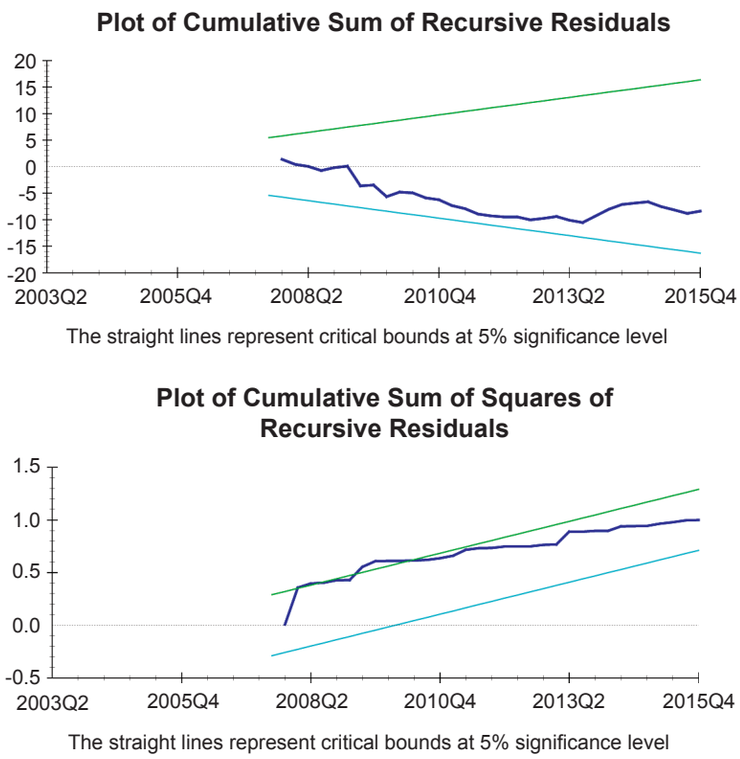

FIGURE 1. Plots of CUSUM and CUSUMQ Statistics for coefficient stability

in formulating their policies, monetary authorities should be cautious of the effects of scenarios below on house prices and the economy as a whole; namely, the positive correlation between aggregate house prices and NPF of Islamic banks in the long run, the existence of error correction mechanism as the adjustment process for house prices and bank risk to restore the long run relationship, and the significance of the short run impact of house prices, GDP and interest rate on Islamic bank risk.

CONCLUSION AND POLICY RECOMMENDATION

The study empirically examines the long run and short run dynamic relationships between house prices, Islamic bank risk and macro variables for the case of Indonesia. Employing Autoregressive distribution lag (ARDL) approach and quarterly data spanning from 2002Q1 to 2015Q4 we find the existence of long run relationship between house prices and Islamic bank risk. However, when disaggregate house prices data are employed, the evidence of long run relationship only exist for medium and large houses' prices. The estimated long run coefficient is found to be supportive to the deviation hypothesis. Furthermore, results from the impulse response functions (IRFs) and error correction mechanism (ECM) reflect the short run dynamic interactions between house prices and bank credit. The results from aggregate system seem to be supportive to the collateral value hypothesis. Meanwhile, the disaggregate analysis reveals that only small-house prices have the relationship with Islamic bank risk, and interestingly, the results support the deviations hypothesis.

Moreover, the price of small-house tends to be sensitive to the NPF as compared to that of the medium and large houses. This is justified as the people who buy small houses are commonly those who earn less income as compared to those who buy medium or large houses. The association between interest rate and NPF also reveals similar ideas whereby the magnitude is higher $(0.07)^3$ for

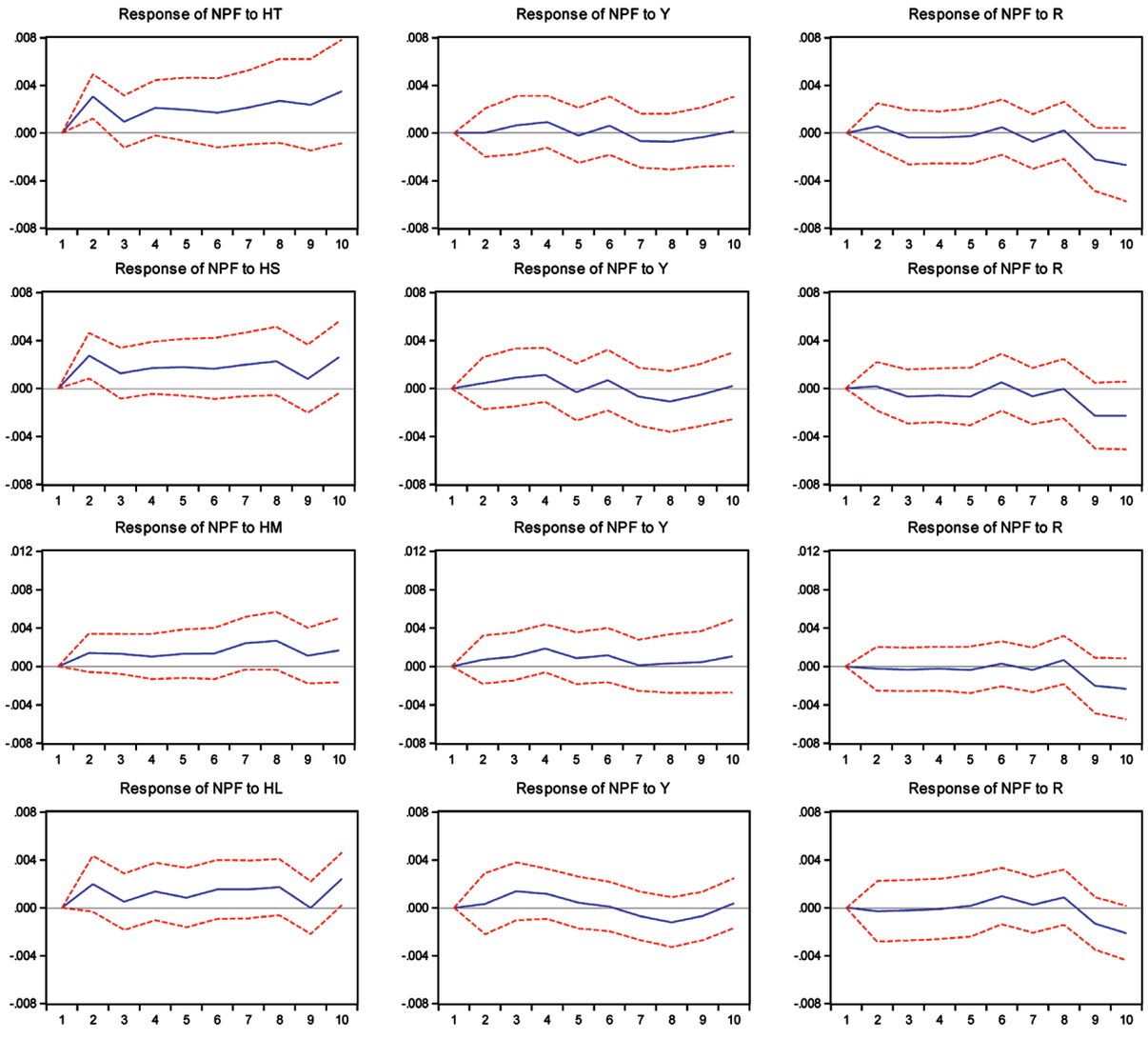

FIGURE 2. Generalized impulse response functions of the aggregate and dis-aggregate house price system

the people who buy small houses as compared to those who buy medium and large houses (0.002)[4].

Policy recommendation by this study is that the central bank as the regulator should formulate a policy that favors the buyers of small houses. This policy should enable the low income earners to buy their houses by managing the interest rate or the margin rate. For example, the central bank can give incentive to commercial banks to offer lower interest rate/margin rate to property developers which construct small houses so that the ultimate house price will be affordable by the low income earners. Another incentive is for bank/ Islamic banks to offer lower house financing rate to the low income earners. The incentive for the commercial bank can be in the form of lowering the amount of reserve requirement that banks have to place with the central bank.

This means that those commercial banks which give lower financing rate to property developers and lower house financing rate to low income earners are at an advantage. Since the banks already support the real sector, the central bank has to provide an incentive by lowering the amount of reserve requirement. The relationship between Islamic bank and the role of real sector is important as suggested by Sukmana and Khalid (2013).

The results of the study have opened a variety of possible areas that warrant further research. It is important to highlight that while this study focuses on the importance of the house prices to Islamic banks' stability, several other factors might be important in affecting the Islamic banks' stability. Among others, specific type of financing contract, other bank specific factors, and regulatory changes on banking sectors as well as property markets might also affect Islamic banks' stability. Other issue for further study would probably lies on the assessment of the individual bank level data instead of aggregate-level data. Certainly this will enable us to comprehend the analysis. Another area of possible extension is to employ different type of risk/stability measurement to ensure the consistency of the results.

ENDNOTES

1 We consider all types of houses in our analysis, namely: aggregate house price index (HT), small house (HS), medium house (HM) and large house (HL).

2 Other than AIC, We have estimated using R-BAR Sqared, SBC, HQ and all criterias have a consistent result with AIC. To conserve space, we only present the AIC.

3 Coefficient of interest rate to small-house price in Table 5.

4 Coefficient of interest rate to medium and largehouses' prices in Table 5.

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