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The Analysis of Residential Property Price Bubble and Sharia Bank Financing Using MIDAS Regression Model

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Abstract

In economic modeling there are constraints in terms of time frequency differences in the data used as input for estimating a model. One real example is when modeling the relationship between the Islamic banking financing (FIN) and the Housing Price Index (HPI), where the frequency of FIN data is monthly and HPI is quarterly. In this study, it has been tried to develop a model which can be used in the forecasting of Residential Property Price Bubble by using MIDAS (mixed data sampling regression) method which allows the series to be used in the same regression equation from different frequency.

Considering the AIC and SIC criteria, it was found that the best performing model out of four alternatives was the weighted equation according to the U-Midas method. The research result shows that the MIDAS specification for modeling the relationship between Islamic bank credit and the property price index is MIDAS with the U-Midas function at lag 4. This model is able to explain variations in property price bubbles of 98.8916%, meaning that the model can be used well for forecasting. Performance the resulting forecast is very good, it is shown that the MAPE value is 0. 2141%

Keywords: Sharia Bank Financing, Housing Price Index, Bubble, Midas

1. Background

Banking has an important role in minimizing transaction costs and asymmetric information and distributing risk. Banking functions as an intermediary institution used optimally in the economy for the needs of society both by surplus and fund deficits (Mishkin, 2001). A sharp rise in asset prices is interpreted as *bubble* because its movements cannot be explained fundamentally (Mishkin, 2008). Appearance economic bubble because there are no substitutes for an asset, so the demand for it becomes very high and affects the price and increases the average equilibrium rate of return (Blanchard & Watson, 1982). The experience of countries that have experienced historical financial crises begins to highlight the importance of good macroeconomic, financial and regulatory policies so as to identify and detect bubbles is a major concern in economic policy and literature today. In the rational bubble standard model, bubbles can only occur if the economy is not dynamically efficient so that tests that aim to detect dynamic inefficiencies can be used to determine whether bubbles are possible (Farhi & Tirole, 2012).

So, is it theoretically bubble is existed? there are still doubts and debates about the existence of asset price bubbles. The researchers avoided the term bubble and prefer to see big changes (wide swing) in asset prices as boom and burst, financial imbalance or, in policy formulation, simply as a risk. Since the global crisis in the financial sector which was initially triggered by the crisis subprime mortgage in United States where several financial institutions experienced major bankruptcy due to liquidity problems and declining asset values, the concentration of studies began to shift to housing asset prices, after previously more stocks (Hassan & Orleans, n.d.). Finocchiaro and Heideken (2007) explain that housing asset prices have a more vulnerable impact than other asset prices on the economy. Changes in house prices will affect household aggregate spending because houses are a form of asset and one of the largest portions of bank assets as collateral. In addition, housing prices can predict inflation and output levels better than using stocks as an indicator.

Housing crisisin the United States in 2007/2008 is clear evidence of the large role of the housing sector in the business cycle and economic stability. This crisis even affected the economies of other countries and contributed to changes in the landscape of global economic growth. The results of studies in several countries show that the property sector has a close relationship (backward & forward linkage) with around 240–270 industries, sub-industries and services depending on the level of the country's economy. The property sector has a multiplier effect that drives a series of activities.

Theoretically, the relationship between property prices and bank credit can go both ways. The availability of bank credit will increase the demand for housing and at the same time increase housing prices, due to lower credit interest rates as a signal of expectations of good economic conditions and ease of liquidity faced by households (Oikarinen, 2009). With this behavior, the demand for housing is expected to continue to increase and it is feared that it will continue to push up house prices. Henceforth, it is feared that the relatively high price increase could trigger financial instability in the event of a default by the public who use banking services as a source of financing in buying property and triggering price bubble.

The phenomenon that occurs in Indonesia, the demand for an asset results in a high market price, but the price is still taken by the investor. By knowing bubble, then the potential for excessive purchases can be avoided. In Indonesia research on bubble has not been carried out, meaning that there is a gap between the market price and the actual price. Every asset has the potential bubble so it is necessary to examine every asset that can be used as an investment. Research related to the dynamic relationship between macroeconomic conditions and residential property prices with Islamic home ownership financing is expected to be able to fill in the information gap has not been conducted empirically so far.

Time series analysis is used to perform data analysis that considers the influence of time. Time series data is data that consists of one object but consists of several time periods, such as daily, monthly, quarterly and yearly. Based on frequency, time series data is divided into time series data with high frequency and time series data with low frequency. The existence of differences in frequency in time series data is an obstacle in time series analysis, especially regression because the variables available in data with high frequency (usually independent variables) contain important information, but researchers cannot use information from independent variables directly if the dependent variable has a frequency lower.

Ghysels et al. (2016) find a model that can handle time series data with varying frequencies or mixed frequencies without removing information from the data. This model is called the Mixed Data Sampling (MIDAS) regression model. The advantage of the MIDAS regression model besides overcoming the problem of data with mixed frequencies is that it can minimize the parameters to be estimated and make the regression model simpler. This is because the MIDAS regression model can meet the needs of researchers in retaining information with different data frequencies between the dependent and independent variables and reducing the number of parameters to be estimated. Therefore, it is believed that the MIDAS regression model will have better estimation and forecasting abilities compared to other classical models.

Research using the MIDAS regression model mostly focuses on the United States economy to predict quarterly macroeconomic data using monthly or daily financial data, as was done by Anthony (2007), and Clements and Galvao (2009), but only a few focus on the economy of developing country. In this study, researchers will examine the MIDAS regression model to forecast Indonesia's quarterly property price rate using Indonesia's Housing Price Index (HPI). This is based on the fact that macroeconomic variables are important indicators of economic development, but usually macroeconomic data are available at a low frequency, such as the quarterly period for HPI. On the other hand, financial variables such as Islamic bank financing are available in high frequency and have useful information for future economic development (Stock & Watson, 2003).

2. Theoritical Background

2.1 Housing Price Bubble

Corsett et al. (1998), Bunda and Ca'Zorzi (2009) stated that property prices greatly affect the value of credit extended and vice versa and credit affects GDP. The phenomenon of the simultaneous increase in bank credit and GDP in European countries, because the housing

sector has a large role in the amount of credit provided, the fluctuations in housing prices and demand affect macro variables. Research by Siegel (2003), Holt (2009), Lai et al. (2009), and many other studies also show the effect of falling property sector prices on the economic crisis. In addition, research by Otrok and Terrones (2005), examining 13 industrialized countries, found an effect of house prices on macroeconomic variables. Then if GDP is affected then employment, aggregate demand, inflation and other macro variables are also affected.

Housing as a form of community investment, apart from being a basic need. Housing as a physical asset is one of the dominant or largest components of household wealth compared to financial assets (Zhu, 2011). Although not followed by a sudden decrease in price and demand can lead to macroeconomic instability, the continuous increase in property prices in Indonesia allows for speculative bubble (Scott, 2009). Housing bubble occurs when house prices rise too far from their fair share of fundamental values without innovation and the adoption of sophisticated financial innovations to support their growth (Baker, 2008). Qu Feng and Guiying (2015) mention three important implications, first, the growth rate of house prices is an indicator of house price bubbles. Second, comparing the rental income to price ratio without considering changes or variations in usage fees can be misleading. Third, the expected appreciation in house prices is at least supported by fundamental factors.

Housing price movements are an important macroeconomic variable, especially when there are relatively large price fluctuations (Kivedal, 2013). Housing prices are related to interest rates, so housing prices are one of the main transmission mechanisms in monetary policy transmission. Housing prices are also closely related to business cycle movements as to real variables such as investment, inflation and consumption (Ahearne et al., 2005).

Housing prices bubble have important consequences for real economic activity and may have the potential to destabilize the financial system. Taylor (2004) proves that the low interest rate in the United States due to expansionary monetary policy contributed to the emergence of a housing price bubble. The rise in housing prices continued on events bubble economy is mismatch currency and maturity mismatch and real estate speculation. Residential property is not as a private residence but as an investment making residential property prices continue to increase.

Case and Shiller (2004) provide reinforcement of the fundamental analysis of asset price bubbles due to price acceleration which cannot be explained by fundamental conditions. Non-fundamental elements drive price increases, namely the belief that prices will continue to increase for a long time, which is expressed in the phenomenon of inflation. The always positive trend of inflation will encourage housing price bubbles. Based on this explanation, the housing price bubble is influenced by fundamental factors such as credit, income and inflation.

2.2 Mix Data Sampling (MIDAS)

Ghysels et al. introduced the MIDAS regression model (Ghysels et al., 2004). This model is a regression model to solve the problem of differences in frequency in time series data. In the MIDAS regression model, high-frequency data is not converted into low-frequency data. In

addition, the MIDAS regression model applies the principle of model simplicity by reducing the number of parameters to be estimated.

Along with the development of science, the MIDAS regression model is increasingly being used in research on forecasting macroeconomic variables such as the GDP growth rate in several countries such as the United States, namely Clement and Galvao (2008) and Barsoum and Stankiewicz (2015), in Germany by Marcellino and Schumacher (2010), in England by Castle et al. (2013), in Singapore by Tsui (2013), and in France by Marsilli (2014). Research in these various countries concluded that the MIDAS regression model produces better forecasting results compared to other classical models.

2.3 Research Methods

Research on asset prices and bubble still very few in Indonesia, especially in the context of sharia. The data used in this study is secondary data in the form of monthly time series data for Islamic banking financing data with the notation FINMON 200501 to 202012 and Housing Price Index (HPI) data with the notation HPIQUA 2005Q1 to 2020Q4 obtained from reliable and valid sources.

3. Tools of Analysis

3.1 Detecting Assets Price Bubble

One of the most common methods for empirically identifying bubbles is to investigate the time series properties of the price of the underlying asset. Asset pricing theory states that a bubble component in asset prices exists when prices exhibit explosive behavior. This forms the basis for establishing econometric tests of the stochastic property of prices which is targeted to detect explosive episodes in time series data (Jain, 2016; Caspi, 2017). A new method for detecting bubbles was developed by Phillips et al. (Phillips et al., 2012). This framework is usually referred to as the Phillip, Shi and Yi (PSY) framework and is based on the earlier Phillip, Wu and Yi (PWY) framework (Phillips et al., 2013).

PWY and PSY developed SADF and GSADF test procedures on a model basis present-value stock price with constant expected returns. Within this framework, the day/date-t of Pt's share price is expressed in the Euler equation as follows:

$$P_t = \frac{1}{1+r} [E_t(P_{t+1}) + E_t(D_{t+1})]$$

$$P_t = P_t^f + B_t = \sum_{t=1}^{\infty} \left(\frac{1}{1+r}\right)^I . E(D_{t+1}) + B_t$$

$$Et\ (Bt+1) = (1 + r) \cdot Bt$$

$P\ amount_{tf} = Pt - Bt$, giving B_t called fundamental stock-price and rational bubble. Phillips, Wu and Yi (2011) presented a test Supremum Augmented Dickey-Fuller (SADF), which is known as the PWY test. Then Phillips et al. (2012) presented a test General Supremum

Augmented Dickey-Fuller (GSADF), named the PSY test. Both tests are based on a recursive approach and contain a regression window Rolling Augmented Dickey-Fuller (RADF). The window size of the ADF rolling regression is denoted r_{in}, defined by $r_{in} = r_2 - r_1$ and set minimum window width r_0. The general RADF test procedure is illustrated in the figure below.

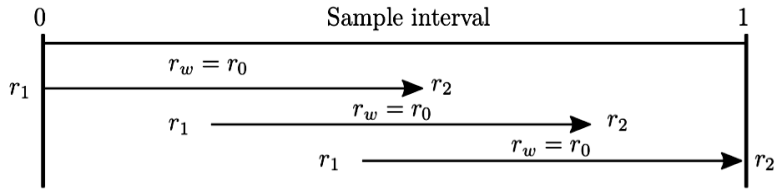

Figure 1. Rolling ADF Procedure

The PWY and PSY procedures are based on empirical equations reduced form, to obtain and GSADF statistical tests:

$$\Delta y_t = \hat{\alpha}_{r_1,r_2} + \hat{\beta}_{r_1,r_2} y_{t-1} + \sum_{i=1}^{k} \hat{\psi}^i_{r_1,r_2} \Delta y_{t-i} + \hat{\epsilon}_t,$$

where k istransient lag order. $a_{r1,r2}$, $b_{r1,r2}$ and $\psi_{r1,r2}$ is a parameter estimated using OLS and y_t is the logarithm of the asset price. r_1 and r_2 shows the start and end points inregression window of the total sample (T). The amount of observed data is indicated by $T_{In} = (Tr_{In})$, where (.) isfloor function. Statistics ADF (t-ratio), expressed by ADF^{r2}_{r1} , $\beta\text{-ratio}_{r1,r2}$against the standard error. Then the ADF rolling regression was performed to obtain the value of the ADF statistical series and detect its presencebubbles. To identify it used the unit root testright-tailed variation of the standard Augmented Dickey-Fuller (RTADF). As the specifications made by Caspi (2017), on PWY and PSY, the following hypotheses are arranged:

$$H_0: \beta_{r1,r2} = 1$$

$$H_1: \beta_{r1,r2} > 1$$

When H_0 accepted then asset price series data has a unit root problem, so it is not stationary and when H_1 is accepted, the data series is stationary so that it has an autoregression coefficient with soft explosiveness (mildly explosive autoregressive coefficients). WhenP value lower than 5%, H_0 rejected, and occurrence or detection of occurrence price bubble. On the other hand, when the P value is greater than 5%, H_0 received and did not occur price bubble. In the PWY test, the null hypothesis has a unit root, the alternative hypothesis has a periodbubble. While the PSY test, the null hypothesis has a unit root, the alternative hypothesis has several periods bubble.

a. Detecting bubble with PWY Test (SADF test)

SADF series statistics are expressed by

$$SADF(r_0) = \sup_{r_2 \in [r_0, 1]} \{ADF_0^{r_2}\}.$$

This test estimates the repeatability of the ADF regression model forward expansion, window size r_{ln} expansion of r_0 (smallest sample) to r_1(largest sample). Data starting point r_1 fixed at point 0, end point varies r_{ln} and ends in $r_2 = 1$ recursive PWY test can be illustrated below

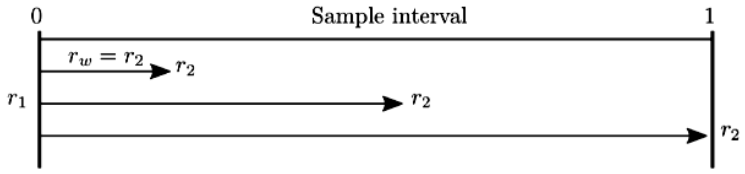

Figure 2. Supreme ADF (SADF) Procedure

b. Detecting bubble with PSY Test (GSADF test)

Phillips et al. (2015a) devised a Generalized Sup ADF (GSADF) process, known as the PSY approach, to detect periods date-stamp bubble, by estimating the repeatability of the ADF regression modelbackward expansion. The GSADF process makes it possible to adjust both the start and end points, or from 0 to $r_2 - r_0$. Consequently the sub samples used in the recursive process are more comprehensive than the PWY test (SADF). Formally the GSADF test is defined as follows:

$$GSADF(r_0) = \sup_{r_2 \in [r_0, 1], r_1 \in [0, r_2 - r_0]} \{ADF_{r_1}^{r_2}\}.$$

The test strength of GSADF is greater than that of SADF. The recursive PWY test can be illustrated below

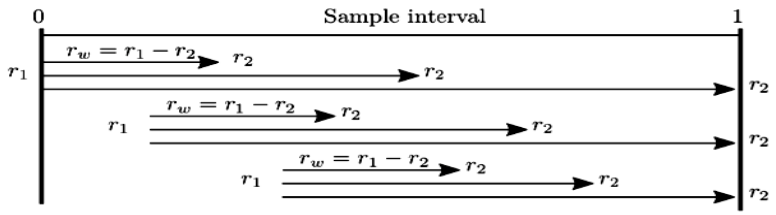

Figure 3. General Supreme ADF (GSADF) Procedure

3.2 MIDAS (Mixed Frequency Data Sampling) Regression

The MIDAS regression specification can be represented as follows:

$$y_t = \boldsymbol{X}_t'\boldsymbol{\beta} + f\left(\left\{\boldsymbol{X}_{t/S}^{H}\right\}, \boldsymbol{\theta}, \lambda\right) + \boldsymbol{\epsilon}_t\,, \tag{1}$$

Where

Y_t : the dependent variable vector at time t is low frequency (low frequency).

X_t : a low-frequency regressor matrix that has the same frequency as$Y_t\{X^H_{t/s}\}$: set regressor with higher frequency than (higher frequency) with valueS for each low frequency.

f : a function that describes the effect of higher frequencies (higher frequency) in regression using low-frequency data.

In equation (1) the Exponential and Beta Almon functions are applied and equation (1) is changed to the U-MIDAS form (Unrestricted MIDAS), as follows:

a. Exponential almonds

The exponential almond function is applied to equation (1) so that it becomes:

$$y_t = \boldsymbol{X}_t'\boldsymbol{\beta} + \sum_{\tau=0}^{k-1} \boldsymbol{X}_{(t-\tau)/S}^{H}{}' \left(\frac{\exp(\tau\theta_1 + \tau^2\theta_2}{\sum_{j=0}^{k}\exp(j\theta_1 + j^2\theta_2}\right)\lambda + \epsilon_t\,, \tag{2}$$

where k is the lag,*l* is the slope,$X^H_{(t-t)/S}$ is a regressor with high frequency lag λ on *t*, θ_1 dan θ_2 is the MIDAS coefficient based on the Almon exponential function.

b. Beta

The Beta function is applied to equation (1) so that it becomes:

$$y_t = \boldsymbol{X}_t'\boldsymbol{\beta} + \sum_{i=0}^{k} \boldsymbol{Z}_{i,t}{}'\lambda + \epsilon_t$$
$$\boldsymbol{Z}_{i,t} = \left(\frac{\omega_i^{\theta_1-1}(1-\omega_i)^{\theta_2-1}}{\sum_{j=0}^{k}\omega_\tau^{\theta_1-1}(1-\omega_\tau)^{\theta_2-1}} + \theta_3\right)\boldsymbol{X}^H_{(t-\tau)/S} \tag{3}$$

θ_1, θ_2 and θ_3 is the MIDAS coefficient based on the beta function

c. U-MIDAS

The U-MIDAS form of equation (1) is:

$$y_t = \boldsymbol{X}_t'\boldsymbol{\beta} + \sum_{\tau=0}^{S-1} \boldsymbol{X}^H_{(t-\tau)/S}{}'\theta_\tau + \epsilon_t \tag{4}$$

This approach estimates a different parameter θ for each high-frequency lag regressor *S*.

d. Estimasi Parameter Regresi MIDAS

Parameter estimation in MIDAS is done by minimizing the sum of squared errors:

$$\underset{\boldsymbol{\beta},\boldsymbol{\theta},\lambda}{\operatorname{argmin}} \sum_{t=1}^{T} \left(y_t - \left[\boldsymbol{X}_t'\boldsymbol{\beta} + f\left(\left\{\boldsymbol{X}_{t/S}^{H}\right\}, \boldsymbol{\theta}, \lambda\right)\right]\right)^2 \tag{5}$$

The minimization process in equation (5) is carried out iteratively using the BFGS optimization method (Broyden-Fletcher-Goldfarb-Shanno). To determine the best model, the authors use value *akaike information criterion* (AIC)

e. Accuracy Index

To test the accuracy of the nowcasting model, the deviation calculation method used for the resulting equations is Root Mean Square Error (RMSE), Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE), and Theil's Inequality Coefficient (U-Theil). These various methods basically have the same goal, namely to measure how close the forecast results are compared to the actual data. The smaller the deviation, the more accurate the resulting model. Each measurement method is written as follows.

Root Mean Square Error (RMSE)

$$RMSE = \sqrt{\frac{1}{m}\sum_{i=1}^{m}(\hat{y}_i - y_i)^2}$$

Mean Absolute Error (MASE)

$$MASE = \frac{\frac{1}{m}\sum_{i=1}^{m}|\hat{y}_i - y_i|}{\frac{1}{m-1}\sum_{i=2}^{m}|y_i - y_{i-1}|}$$

Mean Absolute Percentage Error (MAPE)

$$MAPE = \frac{1}{m}\sum_{i=1}^{m}\left|\frac{\hat{y}_i - y_i}{y_i}\right|$$

4. Results and Discussion

Table 1. Descriptive Statistics

	FIN	HPI
Mean	150669.6	157.1645
Median	119251.2	144.1400
Maximum	409878.0	217.1300
Minimum	3457.872	100.0000
Std. Dev.	130460.0	38.76856
Skewness	0.478438	0.211087
Kurtosis	1.837955	1.503888
Jarque-Bera	34352662	8.055276
Probability	3.86E+12	0.017816
Sum	34352662	12573.16
Sum Sq. Dev.	3.86E+12	118737.1
Observations	228	80

4.1 Financing (FIN)

The development of Islamic bank financing continues to show an increasing number every year. In 2003 the amount of financing was still 5.53 trillion, but it had reached 70.37% of the total assets. On a year on year basis, the amount of financing decreased by 62.31% at the end of 2020. The average financing development was around 137.13 trillion or 30.19% with the highest growth in 2004, namely 107.77% as asset growth shot 95 percent and the lowest was in 2015, namely 7.35%, at that time the BI rate was 12.69%. Financing is the most dominant allocation of funds or assets of Islamic banks. In December 2019, sharia bank financing grew 10.93% less than the previous year which grew 12.08%. The slowdown in financing occurred in consumption financing with the largest percentage, namely 44.38% and growth slowed to 13.07% compared to the previous year of 17.13%.

4.2 Housing Price Index (HPI)

IHPR or HPI is a representation of residential property prices which are calculated according to changes in property prices from surveys in 14 major cities in Indonesia which are considered to represent land or building prices with a base year of 2002. This HPI variable is a proxy for non-financial assets in the form of housing or property prices. The HPI variable shows the minimum of 100, the maximum of 217.13 the mean was 157.16, while the standard deviation was 38.77 during the study period from 80 observed data.

HPI is calculated based on the average resale price of the same property. Indonesia's HPI has a tendency to continue to increase, although, in the first quarter of 2009 it experienced a slight decline from the index of 150.07 to 130.41. The decline in the residential property price index

did not last long in 2009. The deteriorating global economic conditions were responded quickly by the condition of the residential property market in Indonesia so that it was able to show a significant increase in the index in the first quarter of 2012 with the number 144.73. This figure almost matches the highest index in previous years, namely 157.07. Even since it experienced a decline in 2009, Indonesia's HPI continued to increase until the end of the study period. In 2017 the fourth quarter the index reached 219.8. This increase was two times higher than the initial year of the study (2002).

4.3 Asset Price Bubble Detection

People should recognize the existence of a bubble in a particular asset. This knowledge can help early detection on speculative behavior to adjust to selling its assets wisely and carefully, so that market efficiency can be created. This study also helps to determine and detect exactly when it started to occur and when the possibility of a burst appeared.

Table 2. Right Tail ADF Test of HPI

		SADF	GSADF
Prob.*		0.0000	0.0000
t-Statistic		2.801347	4.381896
Test critical values**	99% level	0.985178	1.514320
	95% level	0.516854	1.061168
	90% level	0.204157	0.893822

From Table 2, the two strategies all succeeded in detecting an explosive period with a significance value of less than 1 percent, the SADF and GSADF statistical values for the data series exceed the critical values respectively 2.801 > 0.985 and 4.382 > 1.514 right-tail critical value, provides strong evidence that property prices in Indonesia are subject to explosive sub-periods. Period bubble can be seen in the following

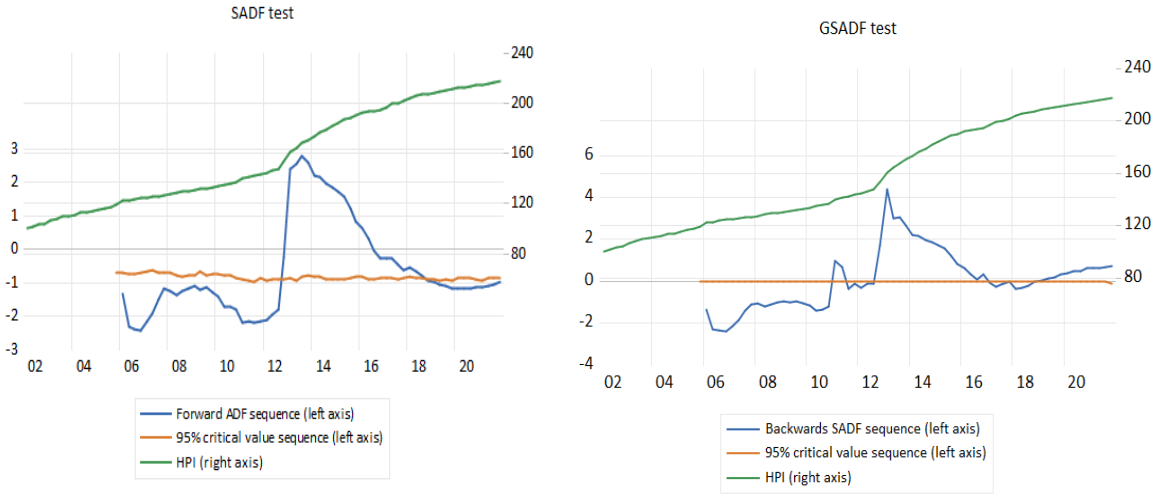

Figure 4. Housing Price Bubble

Table 3. Date-Stamping Periods of HPI

Periode	SADF	GSADF
1	2012Q3 – 2018Q3	2010Q4 – 2011Q2
2		2013Q3 – 2016Q2
3		2019Q1 - …

The SADF strategy succeeded in detecting 1 bubble period, namely the third quarter of 2012 to the third quarter of 2018. According to SADF, in the last few years, starting in mid-2012, property prices in Indonesia have always had explosive values. It can be seen that at the beginning of the bubble period it was quite high in terms of its fundamental value, there were fluctuations during the bubble period. The value of explosive bubbles tends to decrease starting in 2014. Likewise with the GSADF strategy which is usually able to detect bubble periods. In more detail, we managed to find 3 periods, namely the first period occurred briefly around 6 months, namely the fourth quarter of 2010 to the second quarter of 2011. The second period of bubbles occurred at a similar time according to the two tests, namely the third quarter of 2013 to the second quarter of 2016. The third according to the GSADF test lasts a very long time from the first quarter of 2019 to the end of the research period.

In general, the two strategies, both SADF and GSADF, show a bubble period that lasts at least a year if the occurrence is neglected minor bubble. From the two tests above, it can be concluded that the most accurate bubble period occurs at the end of the study period because both show similar results. Property prices are really out of fundamental value. Based on Figure 4, shows a graph bubble Housing Price Index that occurs in the Indonesian market.

4.4 Mix Data Sampling Regression (MIDAS)

Root Mean Square Error (RMSE) is the magnitude of the error rate of the prediction results,

where the smaller (closer to 0) the RMSE value, the more accurate the prediction results will be. Root Mean Squared Error (RMSE) is one way to evaluate a linear regression model by measuring the accuracy of the forecast results of a model. RMSE measures how different a set of values is. The smaller the RMSE value, the closer the predicted and observed values are. Of the five methods in the midas regression, each variable has a significance level, the smallest RMSE is chosen, namely 0.4655

Table 4. Forecasting Model of Midas Regression

	Step	PDL/Almon	U-Midas	Beta
C	0,3384	0,6004	0,6933	0,0769
HPI	0,000	0,000	0,000	0,000
AIC	2,164	1,887	2,7085	2,2635
RMSE	0,5290	0,5626	**0,4655**	0,5639
MAE	0,2999	0,3531	**0,2648**	0,3936
MAPE	0,2419	0,2826	**0,2141**	0,3156

4.5 Mean Absolute Percentage Error (MAPE)

Mean Absolute Percentage error (MAPE) is the absolute (absolute) average percentage error. Definition of Mean Absolute Percentage Error is a statistical measurement of the accuracy of estimates (predictions) in forecasting methods. The smaller the value of the percentage error in MAPE, the more accurate the forecasting results will be.

From this value we can understand that the MAPE value can still be used if it does not exceed 50%. When the MAPE value is above 50%, the forecasting model cannot be used anymore.The smallest MAPE in this study was 0.2141, so the model's ability to predict*bubble* property prices are decent and close to good.

5. Discussion

In this study, the effect of high-frequency indicators (Islamic banking financing) on the performance of housing price bubble predictions (*property bubble*) quarterly was assessed through the MIDAS regression approach. In the analysis using the period January 2002 - December 2021, the results show that housing prices are sensitive to financing with a RMSE value of 0.4655 and MAPE 0.2141, which means that housing prices which contain bubbles are influenced by Islamic banking financing. Based on these findings, it can be said that price movements as well as bubbles can be used for short-term forecasting of housing prices in Indonesia. MIDAS regression model (STEP, U-MIDAS, PDL ALMON, BETA) di used to measure the performance of this prediction with the most suitable U-Midas model to use.

Intuitively, residential property represents a claim on a stream of future payments. In some

cases, it is very easy to define the fundamental value of residential property assets, but it is not possible to determine precisely the unique fundamental value of residential property.Housing bubble occurs when house prices rise too far from their proper limits on fundamental value without innovation and the adoption of sophisticated financial innovations to support their growth (Baker, 2008). Qu Feng dan Guiying (2015) mention three important implications, first, the growth rate of house prices is an indicator of house price bubbles. Second, comparing the rental income to price ratio without considering changes or variations in usage fees can be misleading. Third, the expected appreciation in house prices is at least supported by fundamental factors. Housing (as a physical asset) is one of the dominant or largest components of household wealth compared to financial assets (Zhu et al., 2012). Although not followed by a sudden decrease in price and demand can lead to macroeconomic instability, the continuous increase in property prices in Indonesia allows for *speculative bubble* (Ezalia et al., 2020).

The increase in property prices due to mortgages (KPR) was once a phenomenon in the United States in 2008 which rocked the global economy. This is due to effect *Bubble Property*, where this phenomenon was initiated by the offer of mortgages with low down payments and low interest rates by banks to consumers without regard to the eligibility of these consumers or what is commonly called *subprime mortgage loan*. As a result, there has been an increase in demand from the people of the United States, especially speculators, to buy houses through mortgages. The speculators in question are people who already have a house, but have the desire to buy a second house and so on. This causes property prices to rise sharply beyond their fundamental prices.

Anticipating phenomena *Bubble Property* in Indonesia, Bank Indonesia (BI) implements policies related to the property sector in Indonesia, one of which is the ratio policy*Loan to Value* (LTV) to limit the amount of credit that can be borrowed by the public. The LTV ratio is a comparison between the maximum value that can be borrowed by the community and the value of the property that is pledged as collateral. The implementation of this LTV ratio policy will limit the amount that can be borrowed by the public, with the hope of limiting the growth of property loans in Indonesia and for the long term, can reduce the increase in property prices in Indonesia.

There is a significant influence between the increase in credit and the increase in house prices (Égert & Mihaljek, 2007). (Carbo-Valverde & Rodríguez-Fernández, 2011) investigated the relationship between mortgages and house prices in the short and long term in the period 1988Q4-2008Q4 in Spain using cointegration analysis and*vector-error correction model* (VECM), the result, Valverde and Fernandez (2011) found that mortgages and house prices have a significant relationship both in the short and long term. However, in the short term, significant increases started to occur in 2001Q1 suggesting that increased securitization in home ownership financing may be a factor behind this interaction.

In the United States, (Justiniano et al., 2015) investigates the effect of relaxing mortgage loan requirements on the explosion in US housing prices by using *general equilibrium model*. Justiniano et al. (2019) also found that it was not the limit on loans that caused the explosion in

house prices but the massive securitization in housing finance that was the main cause.

Greenwald and Guren (2019) also examine the effect of the supply of credit on house prices in the US by using *dynamic general equilibrium model*. Heinkel et al. (2001) identified differences in research results regarding the effect of credit on house prices and found that these differences stem from how much landlords and savers with relatively unlimited income levels are able to absorb credit requests driven by agents with relatively high income levels. limited. The results of Greenwald and Guren's research (2019) reveal that nearly half of the credit supply is able to explain the dynamics of house price movements, including the ratio of house prices to house rental costs.

In China, He et al. (2018) studied the effect of bank credit on housing prices in the period 2005Q2-2017Q4 using*vector autoregression model*.(He et al., 2018) They also look at the extent of the relationship between housing prices and mortgages from the demand side and the relationship between housing prices and real estate credit from the supply side. The results of their research show that the relationship between house prices and bank credit is indeed significant but not the same for a certain time. At the global level, the results of a study by the IMF (2011) found that a 10 percent increase in household credit was proven to increase house prices by 6 percent. The results of an IMF study (2011) also suggest that housing policy should not be too focused on aspects of home ownership. The reason is that such steps will actually worsen the level of affordability of housing prices, especially for those with low incomes. The same thing was also expressed by Ryan-Collins (2017). According to Ryan-Collins (2017), the demand subsidy program in the UK has indeed succeeded in increasing the rate of home ownership.

Based on data on the portion of financing channeled by Islamic banking, in 2019 financing for residential ownership is the largest among others (SPS, 2019). It is possible that the availability of bank credit will increase the demand for housing and at the same time increase housing prices (Oikarinen, 2009). In its development, during 2010-2019 housing prices in Indonesia based on the Residential Property Price Index (IHPR) have increased to reach 58% (Bank Indonesia, 2019). Several studies such as Law and Lim (2017), Justiniano and Primiceri (2015), Favara and Imbs (2015), Adelino et al. (2014) found that there is a positive relationship between credit and house prices. Goodhart and Hofmann (2008) in their research found that rising house prices can also trigger banking lending activities. Explosion in house prices will increase the risk of bank bad credit thereby threatening bank stability.

6. Conclusion

The research detected an explosive period with a indicated significance value of less than 1%, provides strong evidence that property prices in Indonesia are subject to explosive sub-periods. The two strategies SADF and GSADF show that the property price index contains bubble. The effect of high-frequency indicators (Islamic bank financing) on the performance of housing price bubble predictions quarterly was assessed through the MIDAS regression approach. The results show that housing prices are sensitive to financing with a RMSE value of 0.4655 and MAPE 0.2141, which means that housing prices contain bubble influenced by sharia bank financing. Based on these findings, it can be said that price movements as well as bubbles can

be used for short-term forecasting of housing prices in Indonesia. MIDAS regression models (STEP, U-MIDAS, PDL ALMON, BETA) were used to measure the performance of these predictions with the most suitable U-Midas model to be used.

Housing bubble occurs when house prices rise too far from their proper limits on fundamental value without innovation and the adoption of sophisticated financial innovations to support their growth (Baker, 2008). Housing is one of the residential property investments that are still in demand by people in Indonesia. The high public interest in buying housing for both residential and investment has resulted in high housing prices due to imbalances in the property market.

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