An Augmented Measurement of the Housing Affordability Cycles in Malaysia

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Abstract: Malaysia's property market has been going through a difficult phase as the supply of property stocks are excessive with the demand unable to catch up, and hence, many unsold units remaining on the market. The primary aim of this paper is to develop an index-based housing affordability indicator known as the housing affordability leading index (HALI), which is based on the indicator compilation approach founded by the National Bureau of Economic Research (NBER). The time-varying Markov switching (TVMS) model is then employed to assess the transition probabilities of the constructed housing affordability indicator. The transition probabilities estimate the prospects of the housing affordability condition and how long it will stay in that particular condition before having any major turnover. As the data employed was monthly data from year 2000 to year 2015, the constructed HALI successfully reflects the prior movements of the non-index housing affordability indicator price to income ratios (PIR). The empirical results show that the HALI has an average leading period of 9.5 months when taking the PIR as a benchmark of coincidence indicator for housing affordability movement.

Keywords: Housing affordability, housing policy, house prices, leading indicator, Markov regime switching
JEL classification: C43, E64, R21, R31

1. Introduction

Housing is a basic human need and one of the important components in an urban economy. Thus, housing affordability is one of the main pillars of development policies to ensure the housing provided is affordable and adequate to cater to the needs of every income earner group, especially the low- and middle-income. A large portion of

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the socioeconomic stability and development of a country is greatly affected by housing affordability. Hashim (2010) and Hussain, Rahman, Husain, Lyndon and Ibrahin (2012) contended that over the last few decades, the residential property market in Malaysia has experienced sky-rocketing house prices, especially in major cities, and that this has caused relative inaccessibility to housing. The problem of accessibility to housing becomes even more critical among the middle-income group earners given that, similar to other countries, the housing needs of the lower-income group are addressed by the government. The middle-income households are concerned because affordability affects not only their ability to become a homeowner, but also the size and type of home they are able to purchase. Thus, managing the growth of housing price and reducing the effects of housing issue is of great importance to every society. Whenever there is a rise in housing issues, eventually it will lead to other social problems. Housing problems are no longer an issue that can be taken lightly and immediate action is required. Since Whitehead (1991) and Chaplin and Freeman (1999), many scholars have delved deeper into the studies of affordable housing in emerging countries; in the case of Malaysia, see for example Mohit, Ibrahim and Rashid (2010), and Tan (2012).

Many factors contribute to the difficulty in defining housing affordability as highlighted by Quigley and Raphael (2004). The problem of affordability is determined by a very complex combination of determinants, including a family's decision to purchase or rent a house, the market supply of new houses, family's ability to obtain approval for a housing loan, distribution of income, and the national housing policies. Thus, a compositive measure of these complex dimension of affordability is essential to gauge this issue. Several studies have been conducted to study the measure of housing affordability including Bailey et al. (2016), Haas, Newmark and Morrison (2016), Hulchanski (1995) and McCarthy and Peach (2004). Several housing affordability indicators have emerged for the sole purpose of measuring or reflecting the level of housing affordability; among others, Sani (2015) suggested there are at least four types of measurement of housing affordability – price to income ratio (PIR), rent to income ratio (RIR), housing expenditure to income ratio, and residual income measure. These housing affordability ratio indicators have been widely practised by researchers and policymakers to portray the movement of housing affordability. Despite this, the ratio indicators can only serve as a coincidence indicator for housing affordability movement, which only provides the current status of the housing affordability level rather than the potential future fluctuations of the cycle. Therefore, policymakers need a forward-looking indicator to predict the future movements of the housing affordability level.

Constructing a leading indicator for housing affordability level is very much possible thanks to the findings of Burns and Mitchell (1946) in the theoretical and methodological development of the indicator constructions for business cycle study. The indicator construction procedure was then carried out by the National Bureau of Economic Research. Since then, the construction of a leading indicator for the purpose of forecasting has been growing drastically throughout the study of the business cycle, for example, Puah, Kuek, Arip and Wong (2015), Puah, Kuek, Arip and Wong (2016) and Voon, Puah and Wong (2016). All the studies mentioned have successfully applied the indicator construction procedure to produce a composite leading indicator that portrayed future fluctuations from their cyclical components.

This study extends the idea into establishing a composite leading indicator to predict the future fluctuations of housing affordability. In this context, not many similar studies are found in the literature. Our findings offer another point of view for policymakers to measure the housing affordability level. Our idea is to utilise a composite leading indicator to predict the housing affordability cycle in Malaysia instead of using the existing indicator, which is based solely on the housing price index and hence, only captures the present and past fluctuations in the property markets. In such a setting, the existing indicator may not provide a good insight into the future fluctuations of people's housing affordability. If we can grasp in advance the potential ups and downs of housing affordability, policymakers can estimate more precisely the number of houses or properties that need to be built in order to avoid any excess in the demand or supply of housing.

To justify the necessity or importance of a composite leading indicator for housing affordability movement, there is a critical need to consider the information obtained from a leading indicator when making policy decisions. The timing of any policy implementation is equally important to the policy itself. As we know that every policy is constructed to tackle specific circumstances on a specific timeline in order to solve a problem, economic or financial, we need to ensure that the correct policy is implemented at the correct time to maximise its optimum effect. When it comes to policy implementation, it is important to be fully aware of the factor of policy lags. Once a policy is implemented, it takes time for the policy to hit the economy and take effect.

In this study, we constructed a composite leading indicator for housing affordability which we have named the housing affordability leading indicator (HALI). The HALI can serve as a tool to assist policymakers to foresee potential future movements in the level of housing affordability. The constructed HALI is assessed with the time-varying Markov switching (TVMS) model improvised by Filardo (1994). The TVMS model produces transition probabilities which estimate the prospects of the housing affordability condition and how long it will stay in that condition before having any major turnover. Therefore, it is always beneficial to heed the call from the early warning signals in order to set up appropriate precautionary procedures.

2. Methodology and Data

2.1 Model Specification and Data

The first part of the construction of the housing affordability leading indicator (HALI) is to ascertain a suitable reference series to represent the benchmark of the movement of housing affordability in Malaysia. In this case, the price to income ratio is employed as the reference series, as Sani (2015) suggested that the price to income ratio is often used as an indicator for measuring housing affordability. The price to income ratio is computed by dividing the average housing price by the median income. Furthermore, many past studies in the literature have suggested that housing affordability is based on house price and income driven market in that its movement is largely in line with the aggregate house price and median income in the state or country. Hence, a fluctuation in the general economic condition can reflect the movement of the housing affordability level.

After selection of the reference series, in the second stage we deal with selection of the component series. Sani (2015) proposed that house price, household income, household expenditure and housing finance influence housing affordability. Additionally, interest is also a main factor in determining the aspect of housing finance (housing loans) in that unemployment rates determine the purchasing power of a country. All selected possible variables are tested for their suitability towards HALI via graphical analysis to examine the trend and movement of the selected variables. Variables selected for constructing HALI are housing prices, gross domestic production, consumer price index, lending rate and unemployment rate. Ying, Luo and Chen (2013) found that house price is one of the main determinants in housing affordability in Guangzhou, China. Almutairi and El-Sakka (2016) indicated that interest rates and inflation rate are indirectly affecting the affordability of housing as interest rates and inflation have a determinating factor towards housing prices. They also found that changes in gross domestic production is driving the movement of housing prices which indirectly induces the housing affordability issue. Quigley and Raphael (2004) also suggested that increment in inflation, interest rates and house prices are prime reasons that makes houses less affordable over time. Bramley (1994) also noted that unemployment rate plays a significant role in affecting the fluctuation of house price, thus affecting the affordability of home buyers. Thus, these variables which affect the housing affordability over time are the ones that changes prior to the fluctuations of the price to income ratios. In comparison with the business cycle indicator developed by NBER which is not a leading indicator but another alternative to reflect economic movement, the similarity is that we proposed the idea of capturing the correlated variables towards housing affordability. However, we improvised the idea of capturing the variables which may indicate leading signals of housing affordability such as those selected for the component series.

We employ monthly data from year 2000 to year 2015. The data used to compute the price to income ratio are average housing prices and median income whereby average house price is collected from the Census and Economic Information Center (CEIC) database. Macroeconomic data including GDP, CPI and unemployment and lending rates are downloaded from the World Bank's website.

2.2 Construction of Housing Affordability Leading Indicators (HALI)

As we have identified the appropriate component series, the subsequent stage is to employ the indicator construction procedure published by the Conference Board (2000). This procedure is basically an index aggregation procedure and is further explained as follows:

i. To calculate the month-to-month changes of the component series, the formula below is applied.

$$m_{i,t} = \frac{X_{i,t} - X_{i,t-1}}{X_{i,t} + X_{i,t-1}} * 200 \quad (1)$$

ii. However, if the component series is in the form of percentage, then simple arithmetic differences is applied.

iii. Compute the monthly contribution for each component series ($c_{i,t}$) by multiplying the month-to-month changes ($m_{i,t}$) with a standardisation factor (f_i). The standardisation factor can be derived by inversing the standard deviation of the month-to-month changes for each component series ($m_{i,t}$).

iv. Sum the adjusted symmetric changes across the component series to obtain the total contribution across all component series for a particular month,

$$S_t = \sum_{i=1}^{n} c_{i,t} \tag{2}$$

v. Set the initial value of the index to 100 and derive the preliminary index of HALI recursively following the formula below:

$$I_2 = \frac{200 + S_2}{200 - S_1} * I_1 \tag{3}$$

vi. Rebase the preliminary index of HALI into the base year of 2010.

2.3 Turning-point Identification

The end product of the above procedure is an aggregate index which we name as the component series. In order to examine the cyclical turning points of the housing affordability level from the growth cycle perspective, a set of transformation procedure will be conducted to transform the reference series, the price to income ratios (PIR) and component series, the HALI in its level form into seasonally adjusted, detrended and smoothed cyclical component before the Bry-Boschan (1971) technique is applied to develop the reference chronology for the Malaysian property market. In addition, Christiano-Fitzgerald (CF) filter will be used for cycle extraction.[1]

In the field of economics and finance, the Christiano-Fitzgerald (CF) filter introduced by Christiano and Fitzgerald (1999) has been well-recognised as a powerful detrending filter to extract the cyclical movement of any time series. It is widely used by macroeconomists to obtain a smooth estimate of the long-term trend component of a series. CF filter gains its popularity in time series analysis since its earliest application in business cycle analysis in 1999. CF filter is fundamentally a smoothing filter that gives a smoothed estimate of the long-term trend of a time series. It is also known as a cycle extraction filter in which the filter is capable of extracting the smoothed cyclical component of the seasonal adjusted time series.

The CF filter also makes use of the whole set of time series data for the construction of filtered series. The approximation of the CF filter can be computed as follows:

$$C_t = B_0 y_t + B_1 y_{t-1} + \ldots + B_{T-1-t} y_{T-1} + \tilde{B}_{T-t} y_T + B_1 y_{t-1} + \ldots + B_{t-2} y_2 + \tilde{B}_{t-1} y_1 \tag{4}$$

[1] Bry-Boschan's (1971) technique is a codified dating rule heuristically documented by NBER on US business cycle data. The algorithm was set up based on certain defined constraints on durations of business cycle, and utilised various moving average methods to identify peaks and troughs in business cycle. It is the pioneer and most popular turning point identification algorithm to date, despite its limitation in application.

where $B_j = \frac{sin(jb) - sin(ja)}{\pi j}, \quad j \geq 1$

$$B_0 = \frac{b-a}{\pi}, \quad a = \frac{2\pi}{P_u}, \quad b = \frac{2\pi}{P_l}$$

$$\tilde{B}_k = -\frac{1}{2}B_0 - \sum_{j=1}^{k-1} B_j$$

From the approximation equation, parameters P_u and P_l are the cut-off cycle length in months. In other words, cycles longer than P_l and shorter than P_u will be conserved in the cyclical term, C_t.

3. Results and Discussion

Figure 1 shows the HALI in its original form and Figure 2 shows the HALI in its cyclical form after the filtering procedure. Figure 3 and Figure 4 depict the PIR and the cyclical form of PIR, respectively.

The two cyclical components of HALI and PIR are then being compared through a graphical visual analysis. As we can see from Figure 5, it shows two curves with twodifferent line thickness, where the thinner line curve indicates the HALI and the thicker line curve indicates the PIR. We also can see that the movements of HALI and PIR are likely to be similar in terms of their fluctuation magnitude and timing. However, we can clearly see that the movement of HALI is ahead of the movement of PIR as we can identify from the turning points of both series.

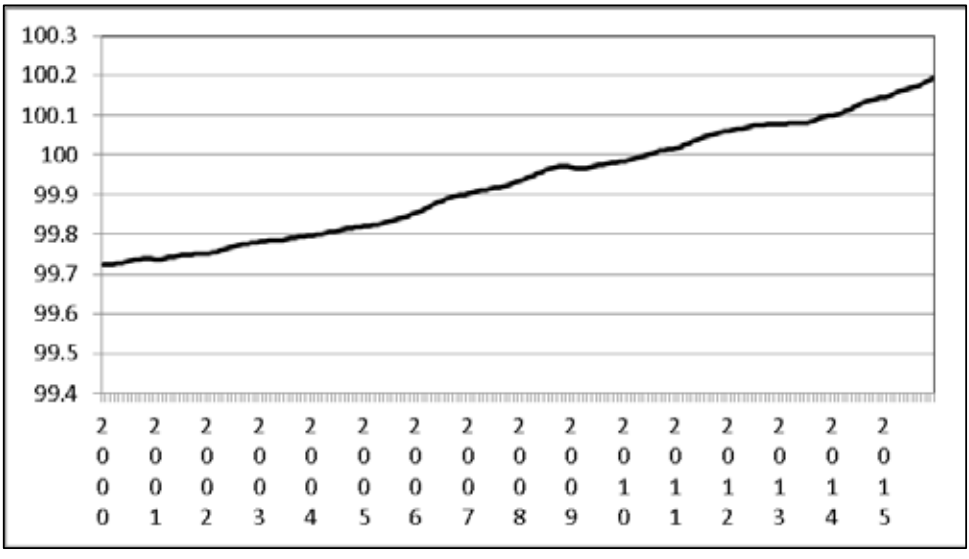

Figure 1. Housing affordability leading indicator (HALI)

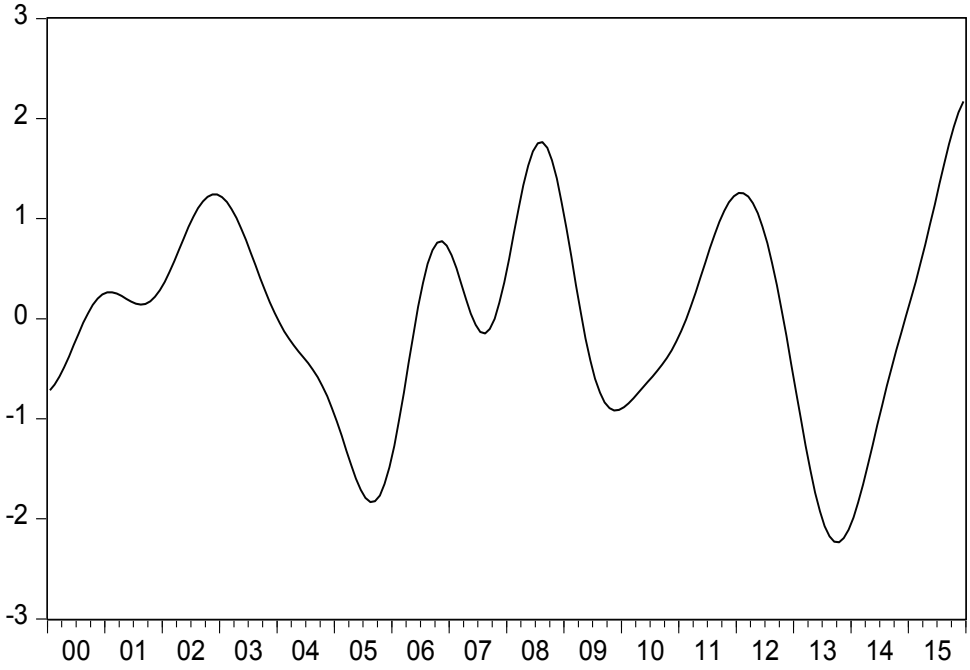

Figure 2. Cyclical component of HALI

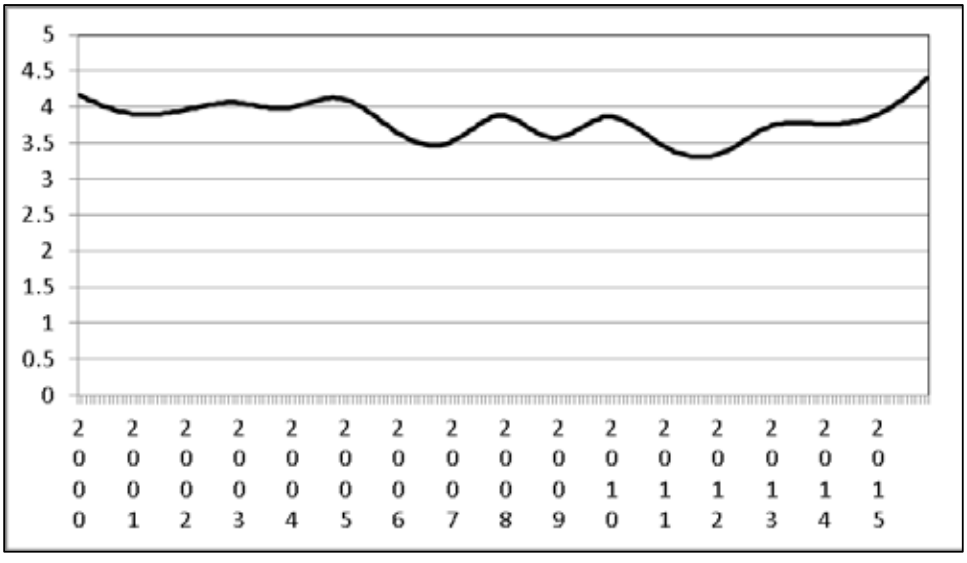

Figure 3. Price to income ratio (PIR)

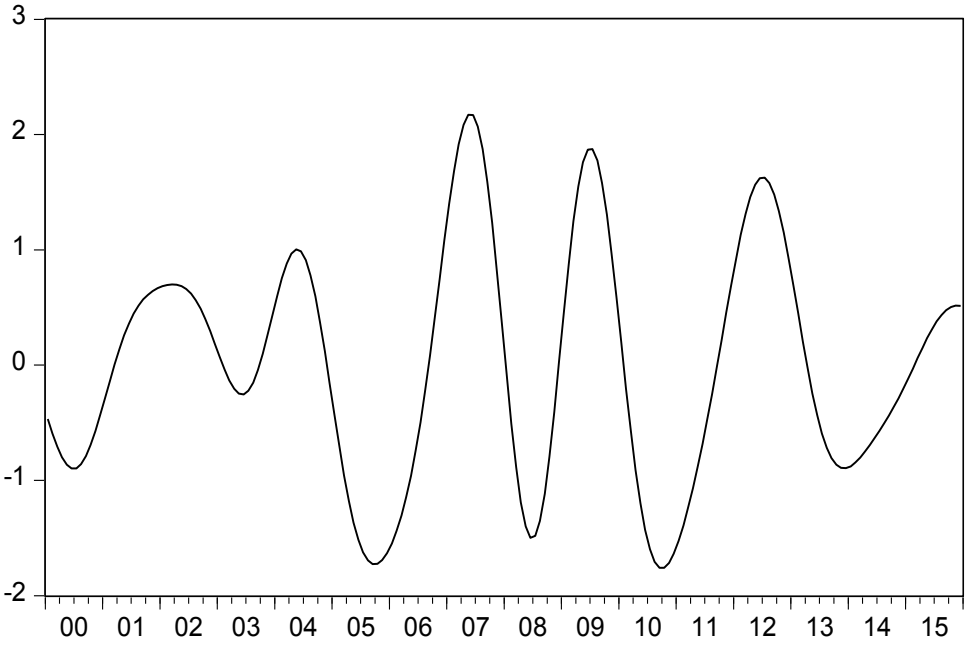

Figure 4. Cyclical component of PIR

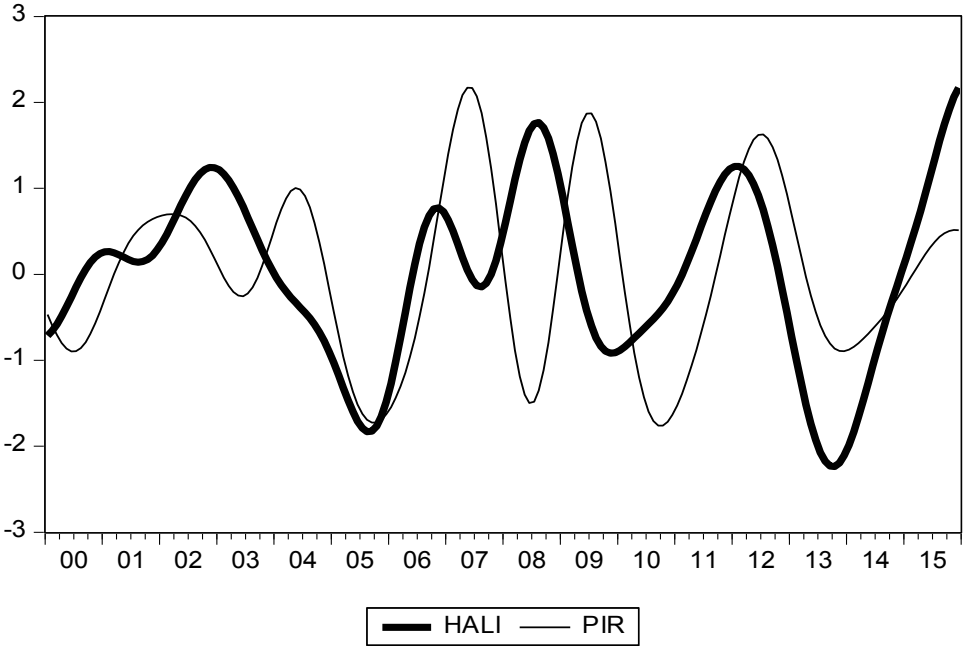

Figure 5. HALI vs PIR

As the HALI and PIR have gone through the filtering procedure, the extracted cyclical components will need to be examined in order to identify the turning points in their cycle. Therefore, for the next step of this study we apply the Bry-Boschan technique proposed by Bry and Boshan (1971). The result of the turning point analysis is tabulated in Table 1.

According to Table 1, the empirical result from the Bry-Boschan (1971) turning points analysis shows that there are 11 and 10 turning points being tracked for the price to income ratios and housing affordability index, respectively. Other than that, the four significant economic events are also being listed in the column indicating major incidents. The empirical results shown in Table 1 is in sync with the empirical results shown by the graphical representation of Figure 5. As we can see from the first cyclical fluctuation, the peak point of the PIR is at 2002m7 and the peak point of HALI is at 2001m2. For the first cyclical fluctuation, the HALI is ahead of the PIR by 13 months, that is before the actual occurrence of the first cyclical fluctuation reaching its peak at 2002m3. The HALI has already provided an early signal to alert about the forthcoming cyclical fluctuation at 2001m2 which is 13 months ahead.

The second cyclical fluctuation happened from 2003m5 to 2004m5 as indicated by the PIR. From the PIR, the trough of the event occurred at 2003m5 and the peak happened at 2004m5. However, the HALI provides another earlier signal with the trough at 2001m9 and peak at 2003m1. The trough of HALI is leading the trough of PIR in advance of 20 months whereby the peak of HALI is leading the peak of PIR in advance of 16 months. Subsequently, beginning from the end of 2005 towards the

Table 1. Turning point analysis

Turning point	Reference series (PIR)	Housing affordability leading indicator (HALI)	Amount of lead/lag	Major incidents
Trough	Jul 2000	–	NA	Dotcom Crisis
Peak	Mar 2002	Feb 2001	13	
Trough	May 2003	Sep 2001	20	Dotcom Crisis
Peak	May 2004	Jan 2003	16	
Trough	Oct 2005	Aug 2005	2	Weakening of housing sector in US and consumer sentiments in Malaysia
Peak	Jun 2007	Nov 2006	7	
Trough	Jun 2008	Aug 2007	10	Global financial crisis
Peak	Jul 2009	Aug 2008	11	
Trough	Sep 2010	Dec 2009	9	Upsurge in Consumer Price Index and Production Price Index
Peak	Jul 2012	Feb 2012	5	
Trough	Dec 2013	Sep 2013	3	Shortage of affordable housing
Average			9.5	

Note: NA – not available.

middle of 2007, there was a major economic downturn in the US due to weakening of the housing sector in the country. Hence, the economic slowdown in the US has affected the overall consumer sentiments in the global market. Nevertheless, Malaysia's consumer sentiment has fallen drastically following the incident in the US housing sector. The PIR recorded the trough of this cycle at 2005m10 and peak of the cycle at 2007m6. On the other hand, the HALI recorded the same incident at the trough of 2005m8 and at the peak of 2006m11. Thus, the HALI is leading the PIR at the trough by two months and by seven months at the peak of the turning point.

The next cyclical event is the global financial crisis which happened over the period of 2008 to 2009. It is obvious that the PIR is able to track down the exact cycle period of the global financial crisis because the PIR shows that the onset of the global financial crisis begins at the trough turning of 2008m6 and reaches the peak turning point at 2009m7. This means that PIR is a coincidence indicator, reflecting the occurrence of event at the exact timing. Without a doubt, the HALI has also managed to show the early signal by displaying its turning points ahead of PIR. The trough turning point of the global financial crisis indicated by HALI is at 2007m8 and the peak turning point is at 2008m8. From the comparison of PIR and HALI, the trough turning point of HALI is in advance of the trough turning point of PIR by 10 months and the peak turning point of HALI is in advance of the peak turning point of PIR by 11 months. Next, there has been an upsurge in consumer price index and production price index over the period of 2010 to 2012. The trough and peak turning point for this economic event recorded by PIR are at 2010m9 and 2012m7 respectively. On the other hand, the HALI recorded its trough and peak turning points at 2009m12 and 2012m2, thus having a leading period of 9 and 5 months respectively. Lastly, for the severe shortage of affordable housing happening over the period of 2012 to 2013. We can see that the PIR has recorded a trough turning point at 2012m7 and peak turning point at 2013m12 whereas the HALI recorded its trough turning point at 2012m2 and 2013m9. The leading period of HALI over PIR for both trough and peak turning point are five and three months respectively. Therefore, on average the HALI is leading the PIR at 9.5 months.

After the dating of turning points, we come to the final stage of the analysis. In this final stage, the constructed HALI is subjected to the time-varying Markov switching (TVMS) model improvised by Filardo's (1994) specification. The TVMS model is extended from the original model of Markov switching model conducted by Hamilton (1989). The TVMS will model the transition probabilities as functions of exogenous information to capture more complicated temporal persistence that carry important information to the housing affordability cycle. For this study, the PIR was modelled by taking the constructed HALI as an information variable. In order to perform the TVSM, the fixed transition probability was modified into a logistic function of a housing affordability variable to ensure that probabilities are always between 0 and 1.

The finding from TVMS explains that the transition probability associated with the unaffordability regime was 0.960, whereas the affordability regime had a relatively lower transition probability of 0.761. Hence, the expected duration for houses to be unaffordable is 25.3 months (2.1 years) while the expected duration for houses to be affordable is 4.2 months (0.35 years). The TVMS model estimates that the average housing affordability cycle lasted about 2.5 years, where the unaffordability period

had a duration of about 2.1 years, while the average period of houses being affordable is 0.35 years. Thus, the affordable phases are, on average, steeper and shorter than unaffordable phases. However, the results from the TVMS may still need more evidence to support the findings. Figure 6 depicts the filtered regime probabilities.[2]

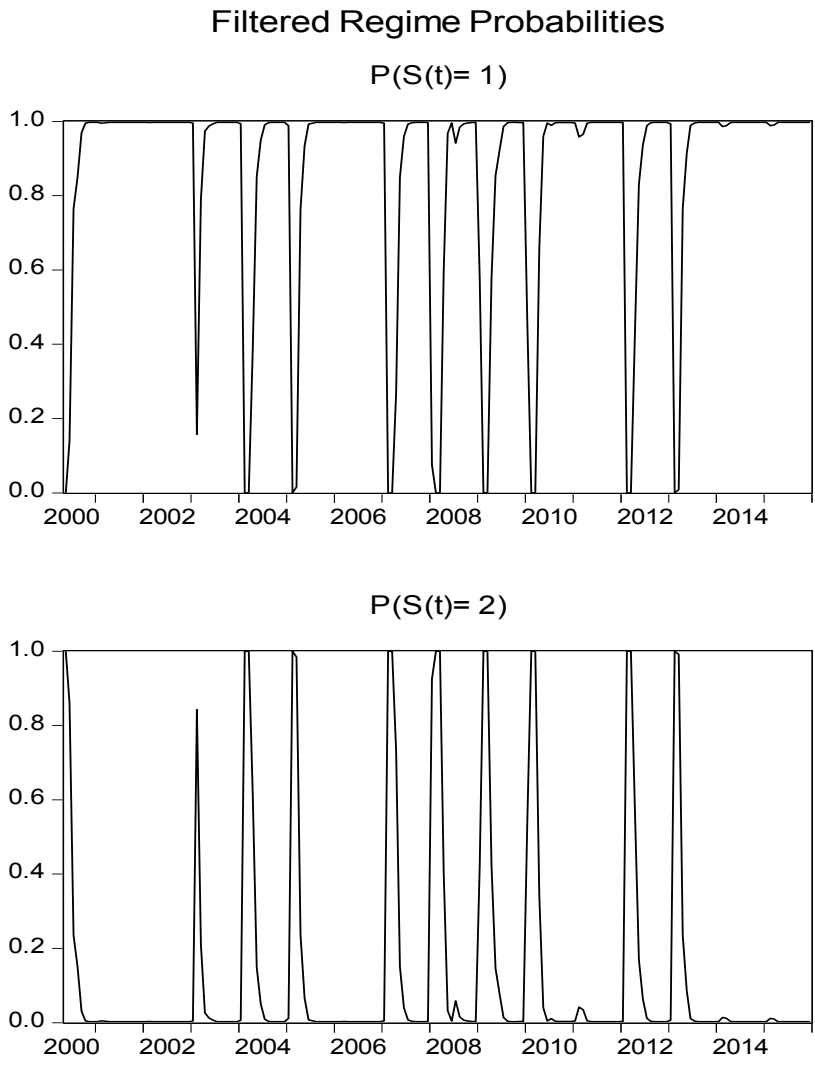

Figure 6. Filtered regime probabilities of unaffordable and affordable period, 2000-2015

[2] In Figure 6, we present the filtered estimates of (time varying) transition probabilities expansion and recession for HALI. Hamilton's (1989) regime-switching model was developed to allow the dynamics of expansion to be quantified differently from those of contraction, therefore turning point detection is able to reflect the information of HALI.

4. Conclusion

In general, this study conveys a new housing affordability indicator for Malaysia. We find that by incorporating various highly correlated variables in the long run, the Malaysian housing affordability level can be improved to predict early movement. The component series that makes up the constructed HALI have essentially suggested that external forces such as foreign direct investment and gross domestic production in the economy can collectively influence fluctuations of the housing affordability in Malaysia. Furthermore, consistent updating of the component series to reflect the contribution of the component series is obviously important to the indicator-based predicting practice in Malaysia. However, further improvement and exploration can be done to equip this study towards an out-of-sample forecasting in the future. To conclude, we have established a novel housing affordability leading indicator (HALI) with leading attributes. The constructed HALI has been authenticated to have a prominent leading period of 9.5 months on average. We hope our housing affordability index can serve as a guideline to other alternative approaches to predict market movements in the Malaysian housing market. We hope our measure offers a good potential in assisting government policy implementation in the future.

Last but not least, the limitation of this study is the inconsistency of the predictive period of HALI towards its reference series. Although each turning point of HALI is leading its reference series, the difference of time among the leading periods are undeniably wide. Therefore, future studies may improve in terms of a component series selection or by identifying a more accurate component series which has a relatively higher correlation with housing affordability.

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