Housing Affordability Index in Korea

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Abstract

Many countries are computing the Housing Affordability Index (HAI) in order to testify housing purchasing power. However, Korea has never tried to calculate HAI while housing price indexes are constructed and published weekly. This study computes Housing Affordability Index of Korea and testify the usability of leading indicator in the housing finance market. The main results are summarized as follows: First, HAI shows different path from PIR, the existing housing affordability measure in Korea. Second, HAI can cause the housing construction starts and housing loan balance. The findings provide some policy implications. First, we can compute reasonable HAI with available data in Korea housing market. Second, HAI describes better housing price change and housing demand change after Korea Financial Crisis than any other indexes such as PIR. Third, it is necessary to produce HAI and analyze it with PIR in order to improve the market searching ability. As mentioned, HAI can have different path from PIR and cause housing affordability increase even though housing price increase while the income does not increase. Sometimes the situation can cause rapid housing price change unexpectedly.

Key Words: Housing Affordability Index, Housing Finance Market, Korea

I. Introduction

Prediction of housing demand is very important for housing suppliers such as developers and banks and government officials who enforce the policy. For the last several years, the characteristics of housing demand have been changed from those before the Korea financial crisis (so-called IMF). In other words, after IMF housing demand has become affected by macroeconomic factors as well as fundamental factors like population increase. In fact, there is an argument that sky-rocketing housing price changes are due to the income increase under the limited supply. In particular, low interest rate and expansion of housing loan market caused potential housing buyers' affordability increase.

Therefore, in order to estimate housing demand, it is necessary to analyze the changes of housing affordability of families who want to buy the houses in the near future. The condition of loan such and amount of loan, interest rate, and expiration can be critical factors in decision of housing purchase.

According to the OECD (2006), recent house prices have tended to move together across countries and the extent to which they have disconnected from the business cycle are unprecedented. The results imply that families' financial affordabilities have become more important as well as traditional housing demand change factors like housing price and families' income. Furthermore, it emphasizes importance of residential affordability in estimating housing demand.

In this sense, many developed countries are constructing the Housing Affordability Index (HAI) in addition to housing price index. They used the HAI in order to testify housing purchasing power occasionally. In Korea, there is no HAI while housing price indexes are constructed and published weekly. The HAI is almost useless because ability of getting a loan from bank is not connected not to the affordability of the family but to the house value which they want to buy. In addition, it's very hard to construct regional HAI because representative housing price and family income have not published officially.

This paper constructs HAI of Korea with available and valid data. The usability as the preceding index to the housing market change is testified. In particular, we focus on the effect of affordability change on housing loan demand under controlling the other factors such as interest rate, housing price, income, etc

2. HAI in Foreign Countries

The computing formulas and its data of HAI are various across countries. In general, HAI represent the ability that median income household can afford to median price house by the loan from the bank in addition to the household's wealth. In USA, the definition of HAI is the index purchasing power of a typical family to buy a typical home by using mortgage.

The HAI of the National Association of Realtors (NAR) is computed with typical home price, typical family's income and mortgage interest rate. The typical home price is the median price of a single-family house calculated by NAR, and typical median income is provided by the U.S. Bureau of the Census. Interest rate is the mortgage rate applied in housing loan by Housing Finance Board and HSH Associates.

The basic assumptions are as follows: First, Loan to Value ratio is 80% and the median income family has cash as much as 20% of housing price. Second, 25% of total income can be used to pay the interest and principal of the mortgage loan. Third, interest rate is 30-year effective interest rate in FRM (Fixed Rate Mortgage) or 1-year effective interest rate in ARM (Adjust Rate Mortgage).

The HAI of USA is constructed with income, house price, loan maturity, whereas the other factors influencing on housing purchase are not considered.

HAI of NAR is calculated in the following formula:

① $PMT=MEDPRICE \times 0.8 \times (IR/12)\times[(1+IR/12)]^{360} / \{[1+(IR/12)]^{360}-1\}$

② $MINC=PMT\times 4$, ③ $QINC=MINC\times 12$

④ $HAI=(MEDINC/QINC)\times 100$

PMT=monthly mortgage payment
MEDPRICE=the median price of existing single-family homes in an area
IR=interest rate, MINC=necessary monthly income

Recently, first home buyers' HAI is produced. In the calculation, potential first home buyers are estimated as the families whose heads are 25 to 44 years old. The median incomes of these families are used to construct the first home buyers' HAI. Equity capital of each family is assumed 10% of house price. The typical house price is assumed as 85% of the median house price.

The HAI of Australia uses the same formula with the HAI of USA. However, the only first home buyers' data are used in calculation. The Australia HAI is published by the union of HIA (Housing Industry Associates) and Commonwealth Bank. HIA-Commonwealth Bank HAI measures accessibility to home ownership for an average first home buyer. In calculating the index, only the major costs of ownership are considered, namely the house price and monthly mortgage payments. Costs such as rates, repairs and maintenance and acquisition costs (stamp duty, real estate agents fees etc) are not included. The median price of established dwellings is obtained from home loans financed by the Commonwealth Bank of Australia during the quarter. Aggregate household income and household disposable income is taken from Quarterly Estimates of National Income and Expenditure, ABS Catalogue Number 5206.0. Housing loan rates are those quoted for loans to owner occupiers.

The representative housing affordability index of Canada is RBC (Royal Bank of Canada) Housing Affordability Measures. RBC HAM shows the proportion of median pre-tax household income required to service the cost of mortgage payments (principal and interest), property taxes and utilities on a detached bungalow, a standard two-storey home, a standard town house and a standard condo (excluding maintenance fees). The measures are based on a 25% down payment and a 25-year mortgage loan at a five-year fixed rate and are estimated on a quarterly basis for each province and for Montreal, Toronto, Ottawa, Calgary and Vancouver metropolitan area. The higher the measure, the more difficult it is to afford a house.

RBC HAM = (principal + interest + the others) / (pre-tax household income)

Mean price is used in this study. As previously mentioned, the most important factors are definition of the representative house and its price while the HAI are various in calculating formula and data across the countries. In general, mean price is better representative price than median price from the statistical point of view. However, median price can be better because mean price can be very sensitive when the right-tail distribution of housing price. In contrast, median price has limitation that it is less sensitive to the market change and it's difficult to detect market changes from the median price change. Therefore, the HAI of this study is based on the mean price of standard house instead of median price.

3. HAI of Korea

The formula of HAI estimated in this study is same as those of USA and Australia. The mean price of raw data of the national housing price index of Kookmin Bank is used as the representative price of standard house. The mean income of working class in urban area of Korea is used as a standard income. Interest rate quoted from the weighted average mortgage rate of saving banks published by the BOK.

As reviewed in the previous section, the most important factors are definition of the representative house and its price while the HAI are various in calculating formula and data across the countries. In general, mean price is better representative price than median price from the statistical point of view. However, median price can be better because mean price can be very sensitive when the right-tail distribution of housing price. In contrast, median price has limitation that it is less sensitive to the market change and it's difficult to detect market changes from the median price change. Therefore, the HAI of this study is based on the mean price of standard house instead of median price.

Mean income is best data among available income data because income data of Korea

is not enough to estimate the median income. In addition, variation of incomes among households less than those of the housing prices among various houses in Korea.

In choosing the loan rate for HAI, the best data is 30-year fixed rate mortgage. However, the data can be gotten from the only Korea Housing Finance Corporation (KHFC) and the number of loans is very small. So, the data is not appropriate to HAI calculation.

This study assumes LTV is 50% because the average LTV in Korea housing market is 50% even though KHFC's maximum LTV is 70%. Loan term is assumed 30 years that is maximum maturity of KHFC mortgage loan. Finally, qualifying ratio is 33% in computing the HAI because the maximum qualifying ratio is 33% in the Housing Speculation Zone in 2007.

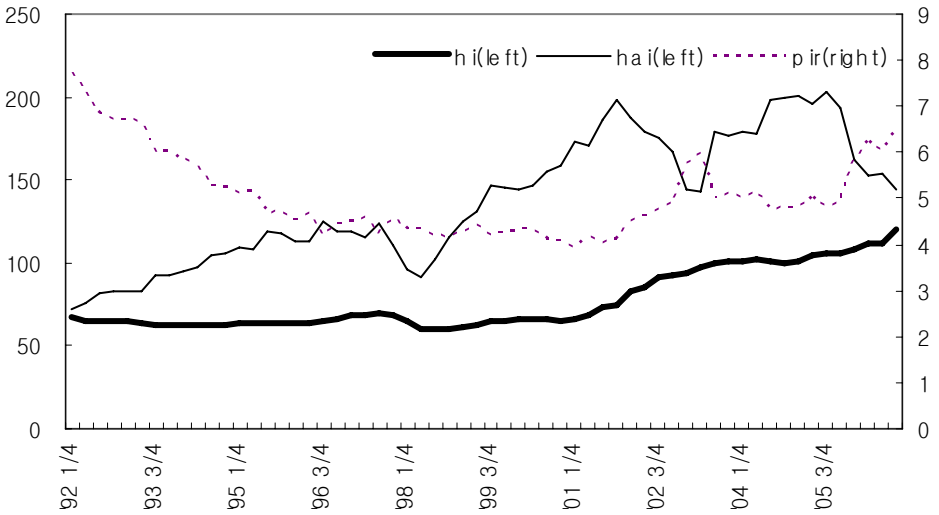

Figure 1. The change of three indexes

HAI of Korea experienced peak in the fourth quarter of 2001 after continuous increasing since 1999. The results are explained by stable housing price and expansion of housing finance market. Since 1999 housing price has shown stable change until the early 2000s while the commercial banks have lowered loan interest rate in order to expand housing loan market which is relatively safer than corporate loan market. Simultaneously, the average household income has increased during the early 2000s. In summary, the early 2000s is the period when housing price increase potential has grown under the surface of the market.

Main factors of housing price increase since 2001 are demand increase by not only income increase but also housing finance market expansion. In other words, sky-rocketing housing price change is due to housing affordability increase by improvement of housing loan condition as well as household income increase and increase of number of households.

The more important fact is that correlation between housing market and financial market became stronger than ever. It implies that extreme change of housing price like bubble burst can cause financial market crisis now. This is the big difference between 1990s

and 2000s in the housing finance market.

Figure 1 shows clearly the difference between PIR and HAI. From 1999 to 2001, HAI had increased very sharply while PIR had decreased slowly. For the HAI represents housing affordability with housing price, household income, housing loan interest rate, whereas PIR shows the ration of housing price to the income without considering loan condition.

The most important fact in figure 1 is the fact that HAI has increased with housing price rising since 2001 while PIR change has been flat since 2003 after short-term increase for about two years after 2001. The different paths of two indexes can be explained as follows: rapid housing price increase has caused rapid increase of PIR, however expansion of housing finance market has increased effective housing affordability by giving more opportunity of loan finance when households buy a house. In fact, housing mortgage interest rate has decrease from 6.86% in July 2002 to 5.41% in May 2006.

4. Usability of HAI

This chapter testifies the usability of HAI as a leading indicator of housing loan demand by Granger's causality test. In general, Granger causality model use the following eguation:

$$X_t = cons\tan t + \sum_i \delta_{xi} X_{t-i} + \sum_j \delta_{yj} Y_{t-j} \qquad (1)$$

The equation (1) is to test whether Y is the leading indicator of X or not. If δ_{yj} is statistically significant and the overall model is significant, Y is the leading indicator of X statistically.

Before test by equation (1), it is necessary to test whether the variables have unit root or not and whether the cointegration exists between variables or not. When the variables have not unit root, level of variables are used for the test. But, when at least one of two has unit root, level of variables cannot be used for the test. In the case, conintegration test is necessary. Level of variables are used when conintegration between two variables exist eventhough at least one of two has unit root. However, the case when variables have unit root and have not cointegration simultaneously, the lag difference of two variables are used to test Granger's causality.

Unit Root Test

Unit root test is the stationary test of time-series variables. If a variable has unit root, it means the variable is not stationary. In this study, Philips-Perron unit root test was adopted. If the statistic of the PP unit root test is greater than the threshold, we cannot accept the null hypothesis 'the variable has unit root' and the variable is stationary.

Table 1 shows that the four variables have unit root and non-stationary. The first difference of levels and the first difference of log levels have not unit roots. The four time-series are HAI (Housing affordability Index computed in this study), hconst (housing construction starts), rmort (housing mortgage effective interest rate) and h_loanb (housing loan balance).

Table 1 Unit Root Test

	t-statistics		
	without trend	**with trend**	**Lag order(k)**
Levels			
hai	-1.73	-2.05	3
hconst	-2.54	-2.52	3
rmort	-2.86	-3.57	3
h_loanb	1.27	-.127	3
Log levels			
hai	-1.87	-1.69	3
hconst	-2.20	-2.31	3
h_loanb	-0.49	-1.78	3
First differences of levels			
hai	-3.83*	-3.94*	5
hconst	-5.72*	-5.66*	3
rmort	-4.47*	-4.41*	3
h_loanb	-1.29	-2.23	5
First differences of Log levels			
hai	-3.24*	-3.56*	4
hconst	-4.99*	-4.91*	3
h_loanb	-3.49*	-3.47*	2

Note) * a<0.05

Cointegration Test

Cointegration test is the stationary test of linear combination among non-stationary time-series variables. If there is cointegration among variables, the variables have long-run equilibrium relation. If a set of non-stationary time-series have cointegration, we can test Granger's causality with the levels even though each series has non-stationary. In other words, if all series are stationary, the cointegration test is useless.

Table 2 show the conintegration test results between series. The two sets of series are not stationary when they are combined linearly: HAI vs h_loan and HAI vs h_const. Therefore, for the two sets of variables log differences are used to test causality. In constrast, the other four sets of series have cointegration and the levels of series are used for causality test.

Table 2. Cointegration Test

series	trasce statistics	cointegration
hai vs h_loan	9.7	x
hai vs hconst	13.0	x
hai vs rmort	17.95	o
h_loanb vs hconst	17.65	o
h_loanb vs rmort	18.34	o
hconst vs rmort	21.0	o

Note) critical value 15.5

Granger's Causalitiy Test

The results of Granger's causality tests imply that HAI can be the leading indicator of housing loan demand and housing construction. However, HAI can follow the housing loan change and housing construction change at the same time.

First, there are two-way Granger causality between HAI and housing construction. The relationship can be explained as follows: Housing affordability increase means housing demand increase indirectly and signalize the excessive demand over supply. On the other hand, increase of housing construction means increase of housing supply and cause housing price decrease and causes HAI decrease. In this sense, if the HAI increases more rapidly than housing price, the gap between housing demand and supply becomes greater. The gap means more supply and the developers can catch the effective demand growth by the HAI changes.

Second, HAI and housing loan balance have a close relationship: change of HAI causes housing loan balance and change of housing loan balance causes HAI change. The Granger's causality between two series gives some implications to banks: HAI is the effective and useful market index. If the HAI increase with housing price, the housing loan demand increase is expected. But, if the HAI decrease while housing price increase, bank cannot expect housing loan balance increase. The explanation implies that HAI is more useful leading indicator of housing loan market than housing price index.

Table 3. Granger's Causality Test

Null Hypothesis:	Observation	F-Statistic	Probability
HAI → hconst**	**55**	**3.09**	**0.025**
hconst → HAI **		**2.81**	**0.036**
HAI → h_loanb*		**2.26**	**0.078**
h_loanb → HAI ***	**55**	**5.02**	**0.002**
h_loanb → hconst	56	1.31	0.280
hconst → h_loanb***		**4.95**	**0.002**
rmort → hconst**	**56**	**3.67**	**0.011**
hconst → rmort		0.17	0.949
rmort → HAI	56	2.05	0.102
HAI → rmort		2.03	0.106
rmort → h_loanb**	**56**	**3.13**	**0.023**
h_loanb → rmort***		**3.85**	**0.009**

Note) Sample: 1992Q1-2006Q4, Lags: 4, *a<0.1 ** a<0.05 *** a<0.01

5. Conclusion

This study tried to compute Housing Affordability Index of Korea and testify the usability of leading indicator in the housing finance market. The main results are summarized as follows: First, HAI shows different path from PIR, the existing housing affordability measure in Korea. Second, HAI can cause the housing construction starts and housing loan balance.

The findings provide some policy implications. First, we can compute reasonable HAI

with available data in Korea housing market. In fact, there are few income data and housing price data in Korea. However, sample data can be used to compute HAI and the HAI shows reasonable path in the analysis. Second, HAI describes better housing price change and housing demand change after Korea Financial Crisis than any other indexes such as PIR. In particulsr, for about 2 years since 2000, the HAI increase with PIR increase can explain the housing price increase during the same period. In other words, though PIR increase indicates decrease of housing affordability, housing price increase was realized by increase of housing affordability due to the housing loan market expansion and low interest rate. Third, it is necessary to produce HAI and analyze it with PIR in order to improve the market searching ability. As mentioned, HAI can have different path from PIR and cause housing affordability incrase even though housing price increase while the income does not increase. Sometimes the situation can cause rapid housing price change unexpectedly.

References

Chen, Jian and Zhong Yi Tong. 2006. Housing Affordability in the United States: Why Is It Gloomier Than We Thought? *Proceeding of the 11th Asian Real Estate Society and American Real Estate and Urban Economics Association Joint Conference*, Vancouver, Canada.

Duca, John V. 1996. Can Mortgage Applications Help Predict Home Sales?. Federal Reserve Bank of Dallas *Economic Review* , Fourth Quarter : 21-30

Fisher, Lynn, H. Pollakowski and J. Zabel. 2006. Amenity-Based Affordability Indexs. *the proceeding of the Aian Real Estate Society and American Real Estate and Urban Economics Association Joint Conference*, Vancouver, Canada.

Girouard, Nathalie, Mike Kennedy, Paulvan den Noord and Christophe Andre, 2006. Recent House Price Developments: The Role of Fundamentals. *OECD Economics Department Working Papers*, Uncalssified.

Ji, K. Hyun, Jungin Kim and Jin-Yoo Kim. 2006. Housing Affordability Index in Korea. *The Housing and Urban Affairs Review*. Vol 89 : 37-53.

Leece, David. 2006. Testing a theoretical model of mortgage demand on UK data. *Applied Economics,* 38 : 2037-2051