

Housing Price Hikes by Negative Real Interest Rate? A Differencing Model Test on the housing markets of Hong Kong and Macau

by

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ABSTRACT

This paper aims to test the effect of real interest rate on housing return, by using the differencing model for eliminating the effects of other factors. Even though the relationship has been tested before, but it is hard to eliminate other factors when studying the effect of real interest rate on housing return, especially the supply factor and the trading volume factor. This is the first attempt by using the differencing method to eliminate other factors to find the net effect of real interest rate on housing return, by using a two-city comparison, of Hong Kong and Macau from 2007Q1 to 2013Q4. The result shows that real interest rate imposes a negative effect on housing return, but not the housing supply, *ceteris paribus*.

Keywords: Real Interest Rate, Housing Price

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1. Introduction

The negative relationship between real interest rate and housing return has long been established theoretically since Fisher (1930). However, there have been very few empirical studies on the effect of negative real interest rate on housing return. The reason is probably because negative real interest rate is rare in the world, especially before the 1970s. Theoretically, negative real interest rate is considered abnormal, as it renders Gordon Growth Model and Campbell and Shiller's (1988) Dividend-Ratio Model inoperable. In general, the nominal interest rate should be the market required return of lending (deferred consumption), so interest rate is normally required to be higher than inflation rate. Thus, real interest rate is almost always positive, when real interest rate is defined as the subtraction of inflation rate from nominal interest rate.

However, when central banks are manipulating interest rate for various purposes and by various means, negative real interest rate becomes possible at least in the short term, especially when money supply is no longer restricted by any commodity based standards since the abandonment of the Bretton Woods Agreement in 1971. For example, if a country or a city, such as Hong Kong, is under a currency board arrangement, a linked exchange rate, then both its nominal interest rate and inflation rate would be exogenously determined¹. As a consequence, negative real interest rates have happened twice in Hong Kong in the past 25 years. Hong Kong is probably the only city which has a high frequency of negative real interest rate period. It therefore enables the first empirical study on the impact of negative interest rate on housing return (Yiu, 2009).

Furthermore, similar incident of negative real interest rate periods have been found related to the Lost Decade(s) of Japan in the 1980s, and the subprime crisis of the US in 2007 (Yiu et al., 2009), as well as the Spain housing bubble burst after the European sovereign debt crisis in 2008.

However, most of the empirical studies so far could not control all other factors affecting housing return, making the theory not conclusive. For example, the government of Hong Kong argued that it was due to insufficient housing (and land) supply in the past decade that caused the escalating housing price, rather than negative

¹ To be more specific, nominal interest rates in Hong Kong are exogenously determined by the US interest rates and risk premium required by investors to hold Hong Kong dollar assets.

real interest rate. Insufficient housing supply seems like an alternative hypothesis. However, the insufficient supply hypothesis has not yet been empirically confirmed, probably because it is not a directly testable hypothesis as sufficiency is relative to demand which is not observable.

This paper thus attempts to study the effects of negative real interest rate and housing supply on housing return by comparing two similar cities, Hong Kong and Macau. The insufficient housing supply hypothesis is tested by taking vacancy rate as a proxy for sufficiency. By means of a differencing method, most of the other factors can be eliminated out. Better still, both cities are under negative real interest rate regime and currency board arrangement, but the vacancy rate of housing in Macau is much higher than that in Hong Kong, it is reasonable to argue that there is no insufficient supply in Macau in view of the high vacancy rate of housing. Thus, the escalating housing price in Macau is itself a good refutation of the alternative hypothesis.

The paper is arranged into six sections. The next section conducts a literature review on negative real interest rate and asset pricing. Then the methodology and data are discussed in Section 3. Sections 4 and 5 present the empirical models and results, respectively. A conclusion is provided in Section 6.

2. Literature Review

After the US Subprime Crisis in 2007, there have been many studies confirming the relationship between real interest rate and housing bubbles in the US. For example, Taylor (2009) showed empirically that the unusually low interest rate since 2001 caused the housing boom. Campbell et al. (2009) also found that real interest rate, rent growth and risk premia are the three principal sources of variance in the housing rent-price ratio. Glaeser et al. (2010) suggested that lower real interest rates could explain one-fifth of the rise in housing prices from 1996 to 2006. Altunbas, Gambacorta and Marques-Ibanez (2010) confirmed that low interest rates over an extended period caused an increase in banks' risk-taking to fuel the housing bubbles.

Then, after the Global Financial Crisis in 2008, many more studies along this line have been carried out to test the relationship in other parts of the world. A review of the related literatures before 2008 is provided by Yiu et al. (2010). Rickards (2014) even suggested that it is the Federal Reserve's intention to impose a negative real interest rate situation in the US, so as to achieve a self-sustaining economic growth.

Since 2008, China has also increased its money supply by RMB 4,000 billion (US\$ 570 billion) after the Global Financial Crisis, housing prices in China have then been escalating rapidly. Xu and Chen (2010) found that lower interest rate, faster money supply growth and loosening mortgage down payment requirement caused the home price growth. Yiu and Xu (2012) also found that real interest rate differences explained the differences in housing price changes of various cities in China after 2008. Chen et al. (2012) found empirically that the same effect of money supply on housing price was valid in Taiwan.

Then after the European Debt Crisis in 2010, many studies about the European housing markets also confirmed the relationship. For example, Ayuso et al. (2006) found empirically that the changes in house prices in Spain can be fully explained by the movements in ex-post real interest rates. Henn et al. (2009) confirmed that Spain's housing boom was supported by low real interest rates, among others. Kuttner (2012) also found evidence in many European countries that a rapid expansion of the monetary base was correlated with the growth in housing prices and housing credit.

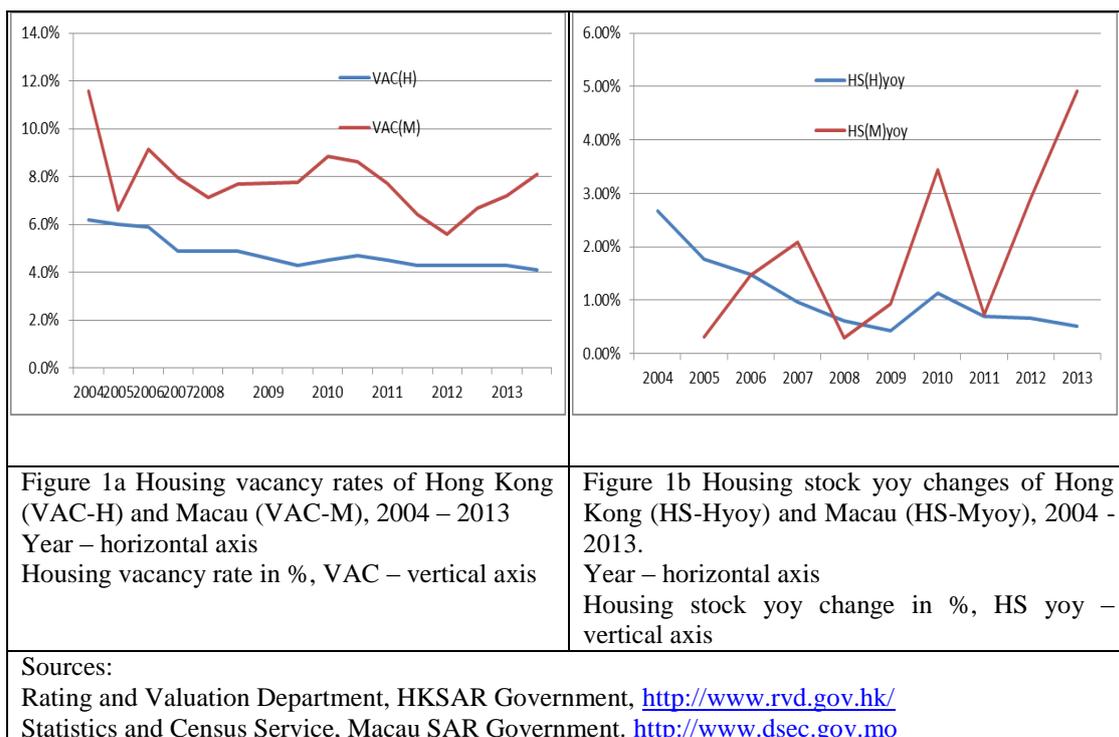
Since Hong Kong and Macau are two of the few economies that are under currency board arrangement, by pegging their currencies (HKD and MOP) to US dollar. The two cities become good laboratories for studying natural experiments on the effects of negative real interest rate on housing prices, because there have already been two long periods of negative real interest rate in the past 2 decades. Yiu (2010) has confirmed empirically the relationship between real interest rate and housing bubble burst during the first negative real interest rate period from 1990 to 1997 in Hong Kong. This paper is a follow-up study of both the housing prices in Hong Kong and Macau during the second negative real interest rate period from 2008 to 2014.

The differencing method can help test critically between the negative real interest rate hypothesis and the insufficient housing supply hypothesis. Vacancy rate of housing is taken as a proxy of supply sufficiency, because it is the only observable result of the interactions between market supply and demand, in both the first hand and second hand housing markets. Peng and Hudson-Wilson (2002) and Hui and Yue (2006) for example have also included vacancy rate as one of the explanatory variables in their studies.

3. HYPOTHESES

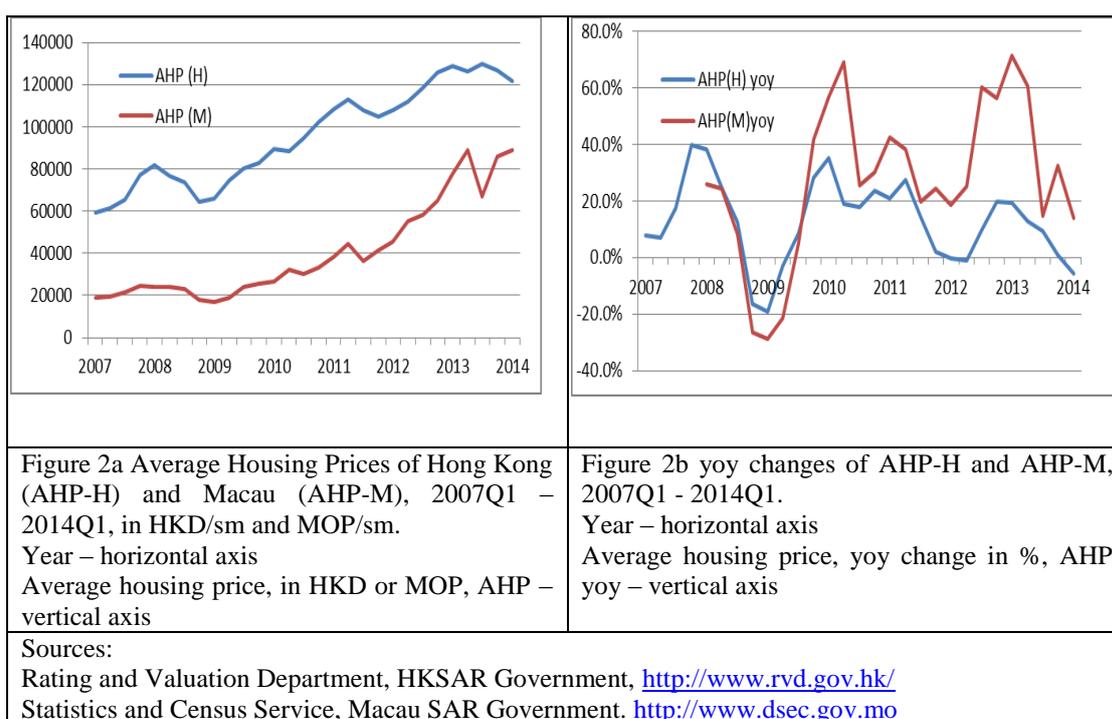
There are two dominant hypotheses in explaining the housing price escalation, namely (1) negative real interest rate hypothesis, and (2) insufficient housing supply hypothesis. This paper is the first attempt to test them by exploiting a cross-city comparative study approach. Since it would be very unlikely to have simultaneously insufficient housing supply in two cities, their housing vacancy rates and housing stock changes indicate their relative sufficiency in housing supply.

Figures 1a and 1b show the housing vacancy rates and housing stock changes in Hong Kong and Macau. They clearly show that the housing vacancy rate in Macau has been well above the natural vacancy rate of 4%, whereas the vacancy rate in Hong Kong has been converging to the natural vacancy rate in recent years. Figure 1b indicates that the housing supply rate in Hong Kong has been much lower than Macau, especially in the recent two years. It can be concluded that there should have no insufficiency of housing supply in Macau. Thus, a comparison of the effect of negative real interest rate on housing price between the two cities is a critical test of the two hypotheses. If insufficiency of housing supply is a reason of housing price escalation, then housing price in Macau should go down in recent years.



Yet, if negative real interest rate is the cause, then if the real interest rate in Macau is more negative than that in Hong Kong, then the housing price in Macau

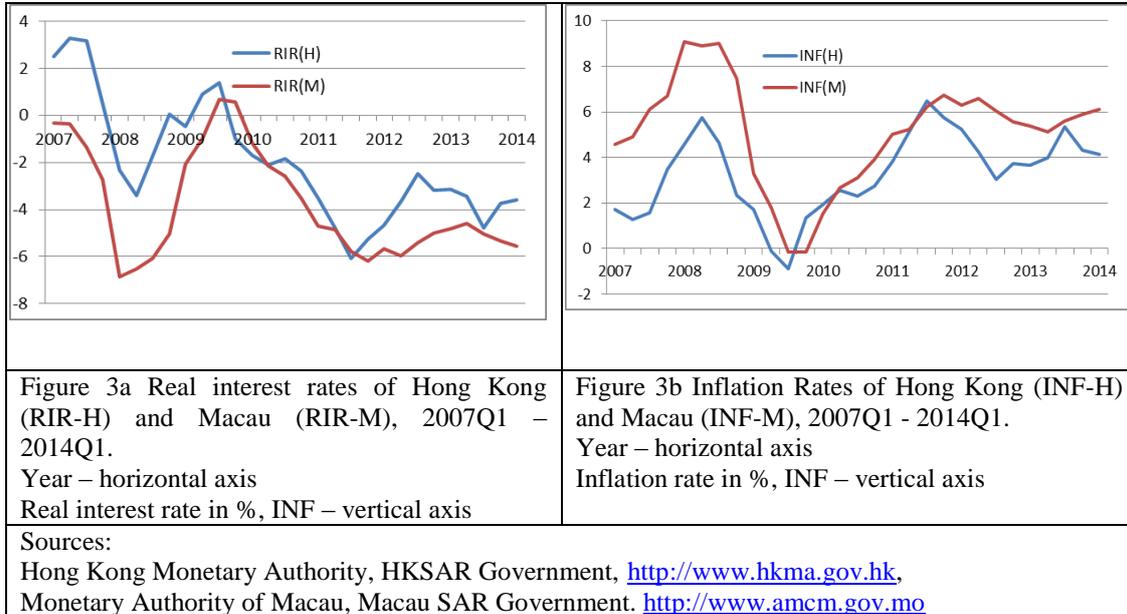
would be expected to increase even more than Hong Kong. Figures 2a and 2b provide some casual observations of housing price in Hong Kong and Macau. Figure 2a shows the Average Housing Price² of Hong Kong (AHP-H) and of Macau (AHP-M) from 2007Q1 to 2014Q1, in HKD/sm and MOP/sm respectively. The housing prices of Hong Kong and Macau have increased by 106% and 366% respectively in the period, and the ranges of price yoy fluctuations are -19.1% - 38.1% in Hong Kong and -29% - 71.6% in Macau (Figure 2b). In other words, the upward momentum of the Macau housing market is much stronger than that of Hong Kong, especially in recent years.



Figures 3a and 3b show the trends of the real interest rates and inflation rates in Hong Kong and Macau. Real interest rate is calculated by subtracting the inflation rate (measured by the yoy of consumer price index) from the inter-bank offer rate (6-month period-end figures). It shows long periods of deeply negative real interest rate in the two cities, since 2008. The averages of their real interest rates are -2.0% and -3.8% respectively. Since the two cities are under the same currency board arrangement, their inter-bank offer rates are almost always the same, but their inflation rates are quite different (as shown in Figure 3b) because of their differences in economic activities. Hong Kong is more reliant on financial industry, whereas

² Since housing price index and transaction data of Macau housing market are not available, the best

Macau is strongly dependent of gaming industry. The averages of the inflation rates are 3.3% and 5.1% respectively. Due to a much stronger inflation in Macau, the real interest rate in Macau has been much more negative than Hong Kong, especially in recent years.

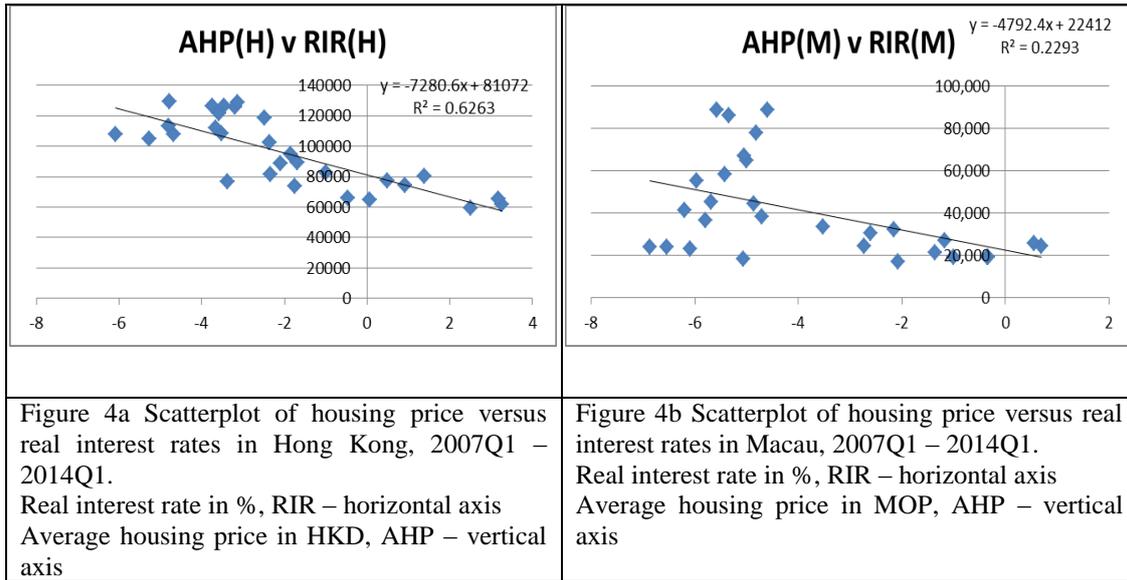


From the above casual observations, it can be inferred that the alternative hypothesis, i.e. insufficiency of housing supply hypothesis, is not a valid explanation for the housing price change in recent years. In contrast, the negative real interest rate hypothesis is confirmed by the casual comparison.

4. EMPIRICAL MODELS

Before testing the two hypotheses more vigorously, Figures 4a and 4b show the scatter plots of housing price change against real interest rate of Hong Kong and Macau respectively. They show strong negative relationship between the two, especially in Hong Kong (the R-squared is 63%).

data available is quarterly average housing price.



Specifically, a differencing regression model is used to examine the impact of real interest rate and vacancy rate (insufficiency in supply) on housing price. By means of differencing, many common effects of similar variables in the two cities, such as transaction costs and market practices, would be cancelled out if the variables are changing together in the two cities. It helps reduce specification bias due missing variables.

The differencing multiple regression model of two independent variables for the hypotheses testing is as shown in Equation (1):

$$AHP(H)-AHP(M) = \alpha_1 + \alpha_2[VAC(H)-VAC(M)] + \alpha_3[RIR(H)-RIR(M)] + \varepsilon_t \quad (1)$$

where

$AHP(X)$ is the average housing price at quarter t of city (X) , $X=H$ or M ;

(H) or (M) H stands for Hong Kong, M stands for Macau;

VAC Housing vacancy rates in % of city X ;

RIR Real interest rate in % of city X ;

α_k are the coefficients to be estimated; and

ε_t are the stochastic terms.

Average housing prices in Macau (in MOP) are directly extracted from the city governments' quarterly statistics, whereas average housing prices in Hong Kong (in HKD) are calculated from the RVD (2014) reported monthly average housing prices of the 5 Classes of housing units. Figure 2a shows that they are increasing in the period. Vacancy rates in % are also available directly from calculating the vacant

housing units from the total housing stocks in the same period of the two cities. However, as vacant units are reported either half-yearly or annually, the quarterly data series is obtained by interpolation. Real interest rates in % are calculated from subtracting inflation rate by interest rate in the same period of the two cities. Both cities' monetary authorities provide data series on interest rates and inflation rates. For the purpose of our study, interest rate is proxied by the inter-bank offer rate (6-month), because it is the longest available series in Macau. Inflation rate is proxied by the composite consumer price index yoy change. Table 1 shows the summary statistics of the differencing variables.

Table 1 Summary Statistics of the Differencing Model, 2008Q1 – 2013Q4

	Minimum	Maximum	Mean	Standard Deviation
<i>AHP(H)-AHP(M)</i>	37,484	71,563	57,417	8,678
<i>VAC(H)-VAC(M)</i>	-4.34	-1.29	-2.97	0.79
<i>RIR(H)-RIR(M)</i>	-1.56	5.12	1.56	1.63

5. RESULTS

Figure 5a shows the time trends of the difference between the average housing prices and the difference between the real interest rates of the two cities from 2008Q1 to 2013Q4, they show a strong negative relationship. Figure 5b shows the scatterplot of the two differences, and the negative relationship is clearly depicted.

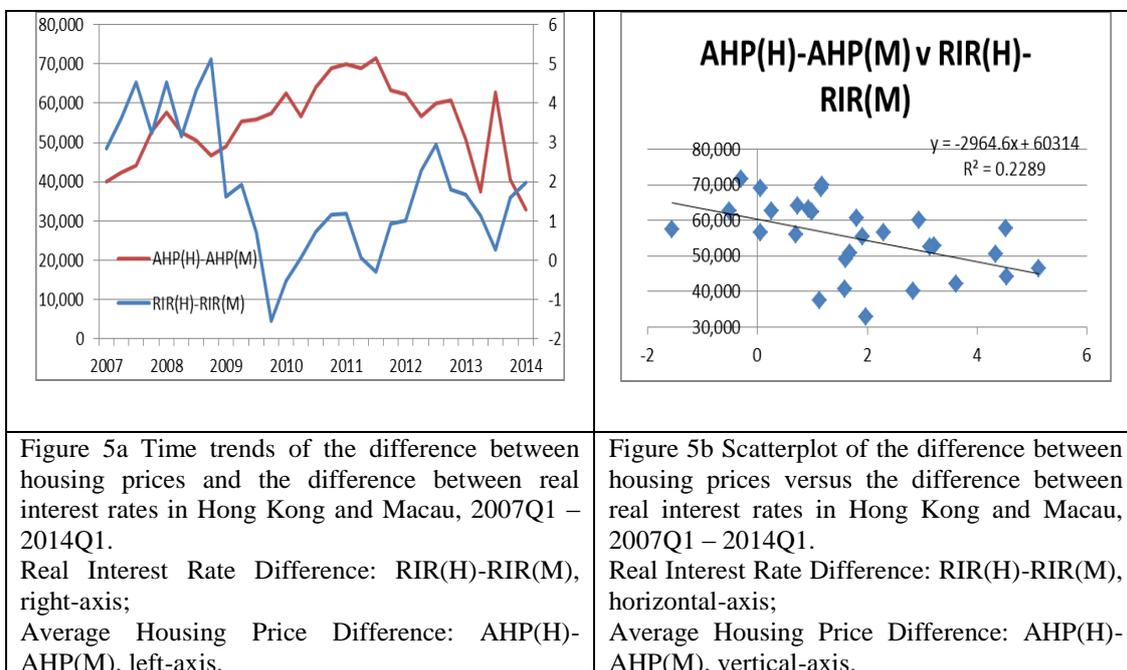


Table 2 shows the results of the regression. First of all, the explanatory power (about 12%) is reasonably high in time series study of this kind. Second, the sign of the coefficient of real interest rate (RIR) is negative as expected and statistically significant at the 5% level, but the sign of the coefficient of vacancy rate (VAC) is not. It confirms that real interest rate difference imposes a significant and negative impact on housing price difference. The result indicates that when the real interest rate of Hong Kong comes closer to that of Macau by 1%, the gap of housing price difference would be increased by about HKD/MOP 2,357³. It agrees in general with all the previous studies on the effect of real interest rate on housing price.

However, the unexpected sign and insignificance of the coefficient of housing vacancy rate difference cannot confirm the alternative hypothesis of insufficiency of housing supply.

Table 2 Regression Results on the Differencing Model, 2008Q1 – 2013Q4

Independent Variables	Coef.	t-stat
<i>Constant</i>	65,099	
<i>VAC(H)-VAC(M)</i>	125,045	0.56
<i>RIR(H)-RIR(M)</i>	-2,357	-2.29*
<i>Dep. Variable</i>	<i>AHP(H) – AHP(M)</i>	
<i>Adjusted R²</i>	0.12	
<i>No. of Observations</i>	25	

Notes:

- 1) * refers to statistical significance at the 5% level.
- 2) Model 1 tests the effects of the difference in housing vacancy rates in Hong Kong and Macau (VAC(H)-VAC(M)), and that of real interest rates (RIR(H)-RIR(M)) on the difference in average housing prices of the two cities (AHP(H)-AHP(M)).

³ Since the exchange rate between the two currencies HKD/MOP has been fixed at about 1:1.03, so the currency exchange rate effect is neglected in the study.

6. CONCLUSIONS

This paper empirically tests the two alternative hypotheses on the cause of housing price escalation, namely (1) insufficiency in housing supply, or (2) negative real interest rate. By comparing the housing price difference in Hong Kong and Macau with the differences in their corresponding real interest rates and vacancy rates of housing, the two hypotheses can be tested critically. The choice of the two cities are because of their currency board arrangements resulting in long period of negative real interest rates, which is rare in other cities. Secondly, they are not only geographically proximate, but they also share a large number of characteristics, such as culture, housing policies, market practices, and transaction costs, etc. Thus, by means of differencing, all these similar effects can be cancelled out, and thus specification bias can be reduced.

The results confirm the negative effect of real interest rate on housing price, but cannot confirm the negative effect of vacancy rate on housing price. It agrees with the casual observations that even though the vacancy rate and its growth in Macau is much higher than that in Hong Kong, the housing price in Macau increases much stronger than that in Hong Kong.

Intuitively, when a city is under negative real interest rate situation, housing asset is taken as a hedge against inflation and a speculation opportunity, housing supply (and vacancy) does not affect much the price, provided that the depreciation and maintenance cost are low. Analogously, just like investors who buy gold as a hedge of inflation do not earn any income yet incurring storage cost, however gold price has increased substantially in the same period because of the currency uncertainty.

The study is however limited by the short data series as the earliest data series available in Macau is 2007Q1. Moreover, as vacancy rates are normally reported infrequently, half-yearly in Macau and yearly in Hong Kong, the quarterly regression model relies on an interpolation of the vacancy rates between the data points. Since vacancy rates change very slowly, interpolation can still be justified.

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