

Availability of bank credit and the residential property price level: evidence from Singapore

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1 Introduction

Easy availability of bank credit has been blamed as one major cause of financial crises from Asia to Latin America. In most cases, credit expansion is associated with a property price boom in the country concerned. IMF (2000) and BIS (2001), for instance, have documented the synchronization of credit and property price cycles.

The consequences of undisciplined credit extension financing a runaway property market can be deleterious and long lasting. Thailand, from which the 1997 Asian Financial Crisis has been largely seen as the source of, saw the collapse of banks and a huge overhang of completed and incomplete properties that persisted for years after the crisis ended. The association between credit availability and the property market is, therefore, an issue of concern to policy makers at national and international levels. For instance, the New Basel Capital Accord which is an impending global regime governing how risks in banking should be measured clearly recognizes the nexus between property prices and credit risk. A mortgaged property was initially considered to provide no protection against credit risk. This implies that a bank cannot presume to make even a partial recovery of the loss from default by liquidating the property collateral. Underlying this prescription is the observation that credit and property prices are so highly correlated that property loan defaults are likely to be accompanied by a depreciation in property prices leaving the lending bank unlikely to obtain a collateral liquidation price close to that on the books¹.

While the coincidence of credit and property prices is unlikely to be disputed, the actual connection between the two has not been well researched. Is it the availability of bank credit Granger causing property price or property price contributing to credit extension? Evidence of the latter has been reported by Hofmann (2001) but the former causation remains assumed rather than proven. In their analysis of the Asian Financial Crisis, Collins and

¹ This rather stringent treatment of mortgaged property as a source of credit risk mitigation has been relaxed after widespread appeals. Even then, property as a collateral continues to be regarded as providing far less credit risk protection than other assets like marketable securities.

Sendhadji (2002) found that credit affects property prices more before than during the crisis. This finding, however, does not allow one to determine if credit expansion is the result of easier availability (supply) or increased demand as shown by Hofmann. In this paper, we will show how the property market in Singapore offers an opportunity to do so.

There are two distinct residential property types in Singapore, public and private housing. Only private housing can be financed by bank loans. Public housing benefits from a government-administered mortgage scheme where the interest rate is pegged to the housing loan rate of the largest local banks. This separation of financing sources allows us to isolate the impact of bank credit availability on property price even after taking the price of credit into consideration.

Ascertaining if and how much bank credit availability can affect the property price level can enable policy makers to adopt more refined measures to prevent another financial crisis arising from the vicious circle of a booming property market and credit expansion feeding into each other till both become unsustainable and collapse. A calibrated curtailing of credit availability for property purchase could be one such measure. In the following section, we will review models of property price determination and show how our study extends understanding in this area. Section 3 provides a description of the Singapore residential property market structure. The research design and results are reported in Section 4 and the last section concludes the paper.

2 Property price modeling

The modeling of property price can be divided into two broad approaches for two distinct purposes. The first seeks to explain property price differentials and is generally referred to as hedonic pricing. A wide range of attributes usually related to desirability or the opposite have been found to affect the market price of a piece of property. In the recent decade, Mok,

Chan and Cho (1995) develop a comprehensive hedonic price model for private properties in Hong Kong. Pompe and Rinehart (1995) show that the width of a beach affects coastal property values in South Carolina and Goffe (2000) finds that intensive livestock farming depreciates the rental value of self-catering cottages in France. Hite, Chern, Hitzhusen and Randall (2001) quantify how environment variables affect residential real estate prices.

The second approach which is more relevant this study aims to identify the macroeconomic factors that determine the general property price level. Here, the results are largely consistent across locations and time periods. Drake (1993), for instance, finds that disposal income and mortgage interest rate together with housing starts are the main exogenous determinants of the residential property price level in the United Kingdom. Ng (1998) reports similar results for the property market in Singapore. All the studies verify the postulated impacts of affordability, proxied by disposal income or per capita GDP and the price of credit which is usually represented by the mortgage interest rate on the property price level. None of them, however, explicitly addressed the issue of bank credit availability. By including mortgage interest rate as an independent variable, the assumption is already made that bank credit is available so whether availability affects property price is probably regarded as of secondary interest. Besides most of these studies employ a single property price determination equation usually formulated to test for other issues of interest. Ng (1998), for example, examines if property price adjusts asymmetrically to property supply changes. But even if there is an attempt to determine the impact of bank credit availability, the current modeling approach may not be suitable.

It is an economic axiom that price and supply are inversely related. This should be no different for bank credit. An increase in credit availability should, *ceteris paribus*, be associated with a decrease in the interest rate on the credit facility. A positive (negative) change in interest rate could therefore, be a proxy for a negative (positive) change in credit

supply. Since mortgage rate has already been shown to be a determinant of the property price level, the supply of housing loans cannot be introduced into the same equation without removing the confounding correlation between rate and supply. For a regression at levels, this can be quite easily achieved. Innovations in one variable whether rate or supply can be first obtained through conventional orthogonalization and entered into the final equation in place of the actual variable values themselves. With equations on property price levels, however, it is less straightforward.

Practically all studies on property price level determination have found that the dependent variable (price level) is cointegrated with the independent variables. As Engel and Granger (1997) have shown, cointegration necessitates the use of differences rather than levels. This means that the orthogonalization process to obtain the innovations must also be performed on differences which makes the eventual property price determination equation harder to interpret. Empirical analysis on a data sample where bank credit availability is exogenously separated from the mortgage interest rate will allow us to avoid this problem. The Singapore residential property market offers such a possibility.

3 The Singapore residential property market

Like in many developing countries where home ownership is encouraged but constrained by affordability, a public housing scheme has been implemented in Singapore not long after the country's independence about 40 years ago. This scheme is administered by the Housing and Development Board (HDB), a statutory board which functions like an autonomous government body. Residential properties, all of which are flats or apartments, are developed by the HDB and sold to eligible buyers through a mainly first-come-first-served system. One eligibility criterion is an income ceiling since the public housing scheme was explicitly designed to overcome the affordability problem of the average citizen. Besides, such

residential properties are available only to family units where at least one of the acquirers must be a Singapore citizen. Given the public policy objective, mortgage financing is practically a necessity for the purchase of HDB properties but legal issues of ownership prevented banks from participating in the housing loan market.

HDB properties are not actually sold outright but leased for 99 years. Legal ownership remains with the Board all the time. Matters like resale or title transfer have to be approved by the HDB. Should a property have to be repossessed due to reasons like unlawful use², the HDB reserves the right to a first claim or lien. Any bank that has provided mortgage financing will have to fall behind and with significant regulatory disadvantages of collateral with subordinate rights, banks have chosen to stay out of the HDB property loan market³. Foreseeing this outcome, the HDB itself has created and managed its own mortgage financing scheme from the start. In the early years, the mortgage rate charged was pegged to the national pension scheme interest rate⁴. This was then revised to a peg to the average mortgage rate of the largest local banks.

There are two price levels for HDB properties, one determined by the Board and the other by the market. During the initial decades, HDB properties sold for the first time (akin to the primary market) were deliberately suppressed to enable mass home ownership. The selling price was unilaterally set by the HDB. Then it was almost a certainty that such buyers would enjoy a capital gain when the property is sold. To prevent abuse, a number of rules were introduced. Any individual, for example, can be a first-time buyer no more than twice

² Throwing litter from a high-rise apartment which have fatally wounded pedestrians in the past can lead to an instant repossession of a HDB property with no compensation.

³ This policy was relaxed only less than two years ago when the Singapore government wanted to strengthen the banking industry. Regulations were changed to let HDB rank *pari passu* with banks which essentially opens up the HDB property financing market to the banking industry. It does not affect the study as the data sample used precedes this relaxation.

⁴ Singapore runs a defined contribution national pension scheme called the Central Provident Fund (CPF) which has been in existence slightly earlier than the HDB. For many years, the CPF interest rate was set lower than bank savings deposit rate using the argument the Fund is almost riskfree. This changed when savings deposit rates started to decline to below the CPF interest rate during the economic distress period in the 1980's. The CPF rate was then revised to be pegged to the average savings deposit rate of local banks.

and the second time must be for a larger size property than the first. Also, a first-time buyer can only resell the property after five years of occupation excluding any renting out which is generally disallowed in the first place.

The resale (or secondary market) price is determined by market forces. Here the rules on ownership are more relaxed especially in the area of income ceiling. Unlike for first-time sale, there is no strict enforcement of this restriction. Besides, the properties are open to Singapore Permanent Residents and unmarried individuals above a minimum age. As such, the HDB resale price is very much influenced by the same factors affected private residential property prices. It is generally observed that resale HDB property prices move in tandem with that of private properties.

With steady economic growth, housing affordability systematically receded as a concern in Singapore. In the recent decade, the emphasis moved from affordability to quality and the HDB revised its policy to peg the first-time sale price to the resale market price.

Besides HDB properties, there is another segment of residential properties generally known as private properties in the country. Pricing dynamics in this segment are largely similar to those in other property markets reported in most published studies with one significant exception. While bank credit is available for mortgage financing as usual, the government has always kept a close watch on the extent of availability both to limit the banks' portfolio concentration and to prevent a property market overheat. Mortgage financing has always been limited to less than 100% of property valuation and lowered when the property market seems like overshooting a sustainable rise. Aside from this intervention though, the private property market is very much left to work out its own equilibria.

The Singapore residential property market presents a unique setting to test for the impact of bank credit availability on property price levels. Here, there are two distinct types of properties where the price levels are driven by the common factors like affordability and

the price of mortgage. The public property market is, however, deprived of bank credit financing but private properties are not. This allows us to clearly separate the effect of bank credit availability from the mortgage interest rate. The Singapore government, in fact, has believed that credit availability does cause property prices and has chosen to use it as a policy instrument to slow down an upward price spiral if necessary.

4 Effect of bank credit availability

Given the consistency in results obtained, the basic model of property price level determination is quite straightforward. For the Singapore property market, Cuervo (1996) and Ng (1998) have found that affordability proxied by the per capital GDP and/or the national wage level and the mortgage interest rate are significant factors. As in other studies, price lags are also shown to be determinants.

As early as Drake (1993), cointegration of property price level with the determinants has always been reaffirmed. Since Cuervo (1996) and Ng (1998) have already found that this is the case for Singapore property prices, the test for cointegration though performed in this study using the Johansen (1987) approach, will not be reported. We will proceed to describe the vector error correction approach after describing the data employed.

4.1 Public and private property data

All the data employed in this study are readily available from public sources. The constraint is the frequency as several of the variable values are available only at quarterly intervals.

Public housing or HDB data are collected from the HDB's website. The HDB compiles an index of average resale prices of its properties every quarter. To reiterate, this resale prices are determined by market forces and not by the HDB so they respond to the

same set of factors that drive private property prices with the exception of bank credit availability.

For private residential properties, the Urban Redevelopment Authority in Singapore, which oversees property development, puts out a Real Estate Statistics publication every quarter. In this publication is an index of private residential property transaction prices per square foot since 1990. The short history of this index is a limiting factor to the study as it allows for only a little more than one decade of data for analysis.

Determinants of the property price level used are similar to those in Cuervo (1996) and Ng (1998). The nominal GDP per capita and the average monthly wage index are collected from the Singapore Monthly Digest published by the Singapore Department of Statistics. These will be employed as proxies of affordability.

Private residential mortgages in Singapore range from 5 to 30 years of maturity. Credit institutions often set the same price for all maturities and compete on special features like a large discount for the first year. The 15-year housing loan interest rate has long been regarded as the benchmark financing cost and the average of this rate charged by the ten largest banks is systematically collated and published every month by the Monetary Authority of Singapore, the central bank. Though this mortgage rate is strictly applicable only to private housing, it can be employed for HDB properties as property price determination is modeled in the form of first difference rather than levels and the HDB pegs its own mortgage rate to this same average 15-year housing loan rate charged by banks.

The key variable in this study is the amount of bank credit available for residential property financing. In Singapore, only banks and finance companies which are essentially smaller domestic banks provide such credit. Given the social importance of home ownership in the country, the Monetary Authority of Singapore has specifically computed and published the total amount of housing loans outstanding every month.

The dataset comprises quarterly values of all the above variables from 1990Q1 to 2001Q4.

4.2 *Modeling property price level determination*

As in other studies, the requisite preliminary for developing a model of property price level determination is to examine the cointegration of the dependent and independent variables. With no significant exception, the null of no-cointegration has been rejected and results obtained for the Singapore residential property market have been no different so far. Employing the Maximum Likelihood test developed by Johansen (1987) and Johansen and Juselius (1990), cointegration among the time series variables used here is confirmed. Existence of cointegration necessitates the use of an error correction approach which will also be the case in this study.

Before focusing on the impact of bank credit availability which is the objective of our analysis, we first confirm the basic formulation of our error correction model. For that, we form a composite index of equal weights in public and price residential property price indexes to capture the overall price dynamics. The determinants are modeled as in equation 1 where

$$\Delta P_t = \beta_0 + \beta_1 \Delta MI_{t-i} + \beta_2 \Delta GDP_{t-j} + \beta_3 \Delta W_{t-k} + \beta_4 \Delta BC_{t-m} + \beta_5 \Delta P_{t-n} + \beta_6 \mu_{t-1} + \varepsilon_t; \quad (1)$$

P is the composite residential property price index;

MI the bank mortgage interest rate;

W the average monthly wage index;

BC the amount of bank credit for housing loans;

μ the residual from the cointegrating vector and

i, j, k, m and n the appropriate number of lags for each regressor.

The level values of the variables were first transformed into natural logarithms so equation 1 is a model of property price elasticity with respect to the determinants.

The sample period overlaps the Asian financial crisis which is generally regarded as having started in mid 1997 and lasted to the end of 2002. Most analysts attribute the trigger of the crisis to the sudden devaluation of the Thai Baht when foreign financing of the Thai economic development, especially in real estate, rapidly decreased. The Thai problem was read as a signal of weakness in Asian economies by international investors whose massive withdrawal of portfolio investments quickly led to a plunge in practically all Asian currency values.

Although not financed by foreign funds as in Thailand, the Singapore property market also experienced a boom prior to the crisis. Not unexpectedly, the crisis adversely impacted real estate values severely. Whether the reversal is purely due to the loss of confidence that began in Thailand or partly a result of an unsustainable run in property prices in the first place cannot be known. The relevance here, though, is the finding by Kiyotaki and Moore (1995) and Hilbers, Lei and Zacho (2001) that there is a positive relationship between bank credit extended to housing and a financial crisis. To accommodate the possibility of the same causality in the Singapore property market before and during the Asian crisis, equation 1 is modified to

$$\Delta P_t = \beta_0 + \beta_1 \Delta MI_{t-1} + \beta_2 \Delta GDP_{t-j} + \beta_3 \Delta W_{t-k} + (\beta_{4a} D_1 + \beta_{4b} D_2) \Delta BC_{t-m} + \beta_5 \Delta P_{t-n} + \beta_6 \mu_{t-1} + \varepsilon_t, \quad (2)$$

where D_1 is 1 for the pre-crisis period and 0 otherwise and D_2 the reverse.

4.3 Results

Results for estimations of equations 1 (without isolating the Asian financial crisis effect) and 2 (with a crisis dummy) are reported in Table 1.

Insert table 1 here

The estimated coefficients validate all the priors in the modeling. As expected, there is momentum in the price level. Affordability has a positive and financing cost a negative impact on price. The lagged effects are, however, not the same for all variables.

Price momentum is present at both one quarter and one year lags (since the data is quarterly, $t - 4$ would be one year). On the other hand, the affordability and financing cost impacts are only one year intervals. This is slightly different from the results reported in Ng (1998) where the mortgage interest rate is significant at one lag. A likely reason for this difference is that the amount of housing loans was not included in that study but dominates the financing cost impact here. This issue will be revisited shortly.

The model which isolates the Asian financial crisis effect as formulated in equation 2 is clearly superior. The adjusted R^2 is higher and dummy for the crisis period has a visibly larger and more significant coefficient than that for the pre-crisis period. The sign is also in the right direction which means that bank credit for residential property financing moved in tandem with price level change as found by Kiyotaki and Moore (1995) and Hilbers, Lei and Zacho (2001). Still, it is unclear yet if this is a supply push effect where credit availability is causing price or the reverse.

Before leaving our summary analysis of the general property price level determination models, the issue of credit availability dominating mortgage interest rate warrants some attention.

The aim of our study is to determine if bank credit availability causes property price. We recognize immediately that formulating a research design to test the hypothesis is not straightforward. Since supply and price are almost certain to be inversely related, credit availability may be so highly (negatively) correlated with mortgage rate to the point that one variable can easily become the inverse proxy of the other. Any true effect of credit

availability could be masked by mortgage rate and a conclusion that credit availability has no effect on property price may actually be erroneous. The result that we obtained here, however, is the opposite. Credit availability is significant at one lag and has displaced mortgage rate at the same lag from the model. Though preliminary, this can be regarded as evidence that bank credit availability does affect property price, a conclusion that is reinforced by our further analysis.

With validation of our priors on the determinants of property price levels, we proceed to test specifically for the impact of bank credit availability. To recap, bank credit is available only for private residential property financing in Singapore until recently (which is later than our sample period). Though the price of such credit serves as the reference for HDB's own mortgage scheme, public housing cannot benefit from bank mortgage financing. There is then a clear divide between the amount of credit available for private and public (none) properties holding the cost of this credit constant. This allows us to isolate the impact of bank credit availability.

We re-estimate equation 1 separately for the public and private residential property price indexes. Though the crisis effect is found significant earlier, it is not central to our study. In any case, it does not change our findings so we disregard the dummy for the Asian financial crisis period. The results for the models of the two indexes are reported in Table 2.

Insert table 2 here

It can be seen from Table 2, that the fit for the model on private property is better than that for the public one. The adjusted R^2 for the former is 69% compared to 60% for the latter. This accords with the choice of determinants since both bank credit and mortgage interest rate are for private properties only. Our interest is in the bank credit variable.

Quite clearly, bank credit affects private property price levels considerably more than that of public property. For private property, the coefficients for lags 1 and 3 are significant whereas only the lag 1 coefficient for public property is significant. Besides, the coefficients for private property are larger, whether at lag 1 alone or aggregated. If we sum the bank credit coefficients for private property, this value is more than three times larger than that for public property.

Although bank credit should have no impact on public property price levels at all, the lagged impact found may be spurious. As reasoned earlier, the mortgage rate for public properties is pegged to that of bank credit for private properties which in turn should be inversely related to credit availability. Public property price then could be respond to bank credit indirectly.

The sum of evidence presented in Table 2 may be regarded as being consistent with the hypothesis that bank credit availability causes property prices. We now evaluate how large the impact is using Cholesky decomposition. The impulse response of property price level to each of the determinants is shown in Figure 1.

Insert figure 1 here

With the exception of bank credit, the impact of each determinant is sustained over many quarters. The difference for bank credit is both interesting and consistent with our findings thus far.

Bank credit makes a positive impact that lasts for about three quarters. The effect then turns negative. This suggests that any change in the availability of bank credit only has a relatively transient impact on property price. Such a result would be more in line with a supply push than demand pull effect since the latter should see a more sustained response function. Besides, the rather short response to bank credit is not inconsistent with the

motivations for residential property acquisition. Affordability and financing cost remain the most important considerations in the property purchase decision. A relaxation or tightening of bank credit availability would at best have a comparatively temporary impact. If fundamentals like income remain unchanged, property acquisition and hence the price level is likely to continue its trend from a new equilibrium. Still the evidence suggests that management of bank credit availability offers policy makers a window of about one year to arrest or boost property prices before fundamental factors alter the trend.

5 Conclusion

The persistent recurrence of national or regional financial crises has attracted interest in identifying the causes of such undesirable events. It has been observed that most financial crises coincide with property price bubbles. Sharp property price increases, in turn, tend to be synchronous with a rapid expansion in bank credit. These findings then suggest that easy bank credit may have fueled property investment resulting in an unsustainable price increase that leads to a financial crash. This causation is plausible and may have contributed to public policy decisions in some countries. In Singapore, for instance, the government decided to restrain bank credit for private residential properties in the early 1990's when the property market seems to be reaching a buying frenzy. To date, however, no study has yet explicitly documented evidence of bank credit availability causing property price.

The difficulty in isolating the impact of bank credit availability lies largely with the indivisibility of supply from price. In a competitive market, supply expansion is generally coupled with a price decrease as postulated in standard microeconomics. Since mortgage interest rate has been found to be a determinant in most property price models, any contribution of bank credit availability may be severely diminished and rendered undetectable.

The residential property market in Singapore offers a unique opportunity to test the hypothesis that bank credit does indeed cause prices. Here, bank credit is available only to private but not public residential properties yet both sectors are affected by the same mortgage rate dynamics as the rate for public properties set by the government body is pegged to those of the banks. In this setting, we have two types of residential properties with market determined prices yet differing in bank credit being available for one type but not the other.

The results obtained are consistent with the hypothesis. First, bank credit displaced mortgage rate as a one-lag determinant of the composite price index level. This suggests that the effect of bank credit availability has not been masked by mortgage rate. Second, separate modeling of private and public property price indexes shows clearly that bank credit affects the former appreciably more than the latter. The aggregate lagged impact on private property price is more than three times that on public property price. Third, a Cholesky decomposition shows that the property price response to bank credit is comparatively short. While responses to fundamentals like affordability and financing cost remain sustained over long periods, the effect of bank credit last only about three quarters. This is consistent with a supply push (bank credit causing property price) rather than a demand pull dynamic which should result in a longer response time since property price cycles usually last for years.

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Table 1

Determinants of the composite quarterly residential property price index in Singapore over the period 1990Q1 – 2001Q4. P is the price index, MI the average 15-year housing loan rate charged by the ten largest banks, W the average wage level, BC the amount of bank credit for private residential properties outstanding, GDP the per capita GDP and μ the residual from the cointegrating vector. D is a dummy variable added to isolate the Asian financial crisis effect. All level values have been transformed to natural logarithms.

Regressors	Without crisis effect	With crisis effect
ΔP_{t-1}	0.355690** (2.96075)	0.239155* (2.05318)
ΔP_{t-4}	0.214364* (1.66689)	0.208524* (2.13411)
ΔMI_{t-4}	-0.184796* (-2.16204)	-0.091816* (-2.28006)
ΔW_{t-4}	0.201695* (2.04003)	0.145313* (2.13330)
$\Delta BC_{t-1} / \Delta D_1 * BC_{t-1}$	0.415099** (3.03738)	0.221586* (2.14312)
$\Delta D_2 * BC_{t-1}$		0.615129** (5.24355)
ΔGDP_{t-4}	0.624868** (5.26667)	0.432229** (3.46374)
μ_{t-1}	-0.150752* (-2.24063)	-0.117564* (-2.29761)
Adj R ²	0.630	0.763
Durbin Watson	1.815	1.922
Jarque Bera	4.216	4.001

* significant at 5% level

** significant at 1% level

t values is parentheses

Table 2

Determinants of public (HDB) and private residential property price indexes in Singapore over the period 1990Q1 – 2001Q4. P is the price index, MI the average 15-year housing loan rate charged by the ten largest banks, W the average wage level, BC the amount of bank credit for private residential properties outstanding, GDP the per capita GDP and μ the residual from the cointegrating vector. All level values have been transformed to natural logarithms.

Variables	Public property	Private property
ΔP_{t-1}	0.692151** (5.26174)	0.332154* (2.28878)
ΔMI_{t-3}	-0.157449* (-2.24987)	
ΔMI_{t-2}		-0.197719* (2.28114)
ΔW_{t-1}	0.251093* (2.18345)	0.574110** (4.11920)
ΔBC_{t-1}	0.211302* (2.1691)	0.425459** (3.05155)
ΔBC_{t-3}		0.313204* (2.17135)
ΔGDP_{t-2}	0.256917* (2.26667)	
ΔGDP_{t-3}		0.672974** (5.23037)
μ_{t-1}	-0.361491* (-2.99072)	-0.475701** (-3.13691)
Adj R ²	0.605	0.689
Durbin Watson	1.813	1.843
Jarque Bera	3.890	8.086

* significant at 5% level

** significant at 1% level

t values is parentheses

Figure 1

Impulse response of private residential property price index to one standard deviation shock to each variable measured using Cholesky decomposition.

