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Housing Affordability and Upward Mobility from Public to Private Housing in Singapore

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This paper examines the ability of buyers to afford and upgrade to private housing using the experience in land scarce Singapore as a case study. The concepts of the “threshold buyer” and “threshold upgrader” are introduced to construct an operational inter-temporal model of affordability and upward mobility, taking into consideration income, mortgage rates, prices of public housing flats and the legislative/financing framework in Singapore. The theoretical private property price computed by the upward mobility model is the lower bound dictated by affordability and cash outlay considerations such that the buyer/upgrader is no better or worse off arising from changes in the relevant factors over time. The model is empirically tested to evaluate the theoretical underpinnings as well as the ability of the model to predict private property price. Finally, the paper examines the implications for housing ownership policy in a wider context.

Keywords

Housing, affordability, upgrade, property price, mortgage rate, income.

Introduction

Conventional wisdom dictates that the ability to afford property ownership depends on the household income and the mortgage payments. *Ceteris paribus*, the higher the household income and/or the lower the mortgage interest rate, the more affordable is the property. Upward mobility in housing is another pertinent issue for households. Typically young families purchase lower-end houses with the intention of moving up to better quality housing or to better locations as their incomes increase over time. Often, the ability to upgrade depends on the appreciation in the value of the lower-end housing as well as inter-temporal changes in income and interest rates. Housing affordability and upward mobility are thus closely related issues.

The housing market in Singapore provides a unique opportunity to study the issues of affordability and upward mobility. This is because Singapore has a strong public housing program that provides low-cost housing. 89% of the population of Singapore lives in public housing provided by the Housing Development Board¹ (HDB) (Doling, 1999; Chua, 1999). HDB flats, being the only public housing in Singapore, are provided with heavy subsidies to make them affordable. In addition, the public housing sector has an active secondary market where prices are market-determined. After a minimum tenure period, HDB flat owners are permitted to sell their flats on the secondary market. Typically, the resale prices of HDB flats, which are determined in the open market, are much higher than the original purchase prices (Ong and Koh, 2000).

The ability to afford (own) private housing in Singapore is limited by the scarcity of land and understandably, high prices. Consequently, the ability to own a private property has become “the Singapore dream.” The accepted wisdom is that the path toward ownership of private property is to purchase a HDB flat first, and to upgrade subsequently (Lum, 1996). The clear delineation of the public and private housing markets in Singapore enables a study of the ability of households to upgrade their housing, albeit the focus in this paper is the upgrade from public to private housing.

Further, under the guidelines provided by the Monetary Authority of Singapore,² purchasers of private property have to pay a minimum of 20% of the property price in cash. In other words, private properties can only be

¹ HDB was set up in the 1960s as a statutory board charged with the provision of high-rise low-cost public housing for a population that was primarily housed in congested and dilapidated city quarters and remote villages without adequate infrastructure.

² MAS is Singapore's de-facto central bank.

financed up to a maximum loan-to-value ratio of 80%. The cash outlay is often the key constraint in private property ownership (Ong and Sing, 1999). Typically, the upgrader, defined as a household that is currently residing in a HDB flat and looking to upgrade to a private property, depends on the appreciation in the price of the HDB flat to provide the equity base to pay for the cash required for the private property. As such, the legislative framework in Singapore provides an excellent case study to examine the question of upward mobility between housing stratum where the relative movement in the prices of the properties in different housing groups is important.

This paper analyzes the issue of affordability for private housing from a demand-side financial cash flow perspective. The concept of “threshold” affordability is proposed whereby the ability to purchase private housing is expressed as a function of income and mortgage rates. Threshold affordability is proposed to capture the idea that the buyer is just able to cross into the threshold of private housing. In addition, this paper introduces the concept of the “threshold upgrader” to construct an inter-temporal affordability and upward mobility model where the cash outlay for private housing depends on the value of the upgrader’s public flat.

Empirical tests are conducted to validate the underpinnings of the affordability and upward mobility model as well as to test the ability of the model to predict private property prices in Singapore. Although the postulated model is a demand-side model, we incorporate a supply side factor in the empirical test, drawing on previous work on the Singapore private residential market by Ng (1998). The results show that prices of HDB flats are significant in determining the prices of private properties.

This paper further demonstrates that the price forecast generated by the affordability and upward mobility model is a good predictor of private property prices. Finally, the implications of the affordability and upward mobility model for housing policy are examined.

Institutional Background

In the housing literature, affordability usually refers to the ability to rent (see for instance Bogdon and Can, 1997). Although the prices of housing in Singapore are high by international comparison, most households prefer to own their homes. The fact that over 81% of the population in Singapore owns their HDB flat could be a reason why ownership is preferred over renting (Doling, 1999; Chua, 1999). Hence affordability in this paper refers to home ownership.

An important feature of private property ownership in Singapore prior to May 1996 is that the mortgage loan and Central Provident Fund³ (CPF) for a private property purchase (also known as the *quantum*) can amount up to 90% of the purchase price or valuation, whichever is the lower. The cash requirement is only 10% and stamp duty can be paid using the purchaser's CPF. An upgrader could utilize the cash proceeds from the sale of his/her HDB flat to pay for 11.5% (10% cash requirement plus 1.5% legal fees) of the price of the private property. The cash sale proceeds is the selling price of the HDB flat less the mortgage balance and CPF refund⁴ (if applicable).

Under the anti-speculation package⁵ introduced in May 1996, the loan and CPF quantum is reduced to 80%. In other words, purchasers of private property are now required to pay a minimum of 20% of the purchase price in cash. The balance 80% can be paid for by the purchaser's CPF or by taking out a bank loan. In addition, stamp duty (approximately 3%) and legal fees are to be paid for in cash. In other words, the upgrader has to have sufficient cash sale proceeds to cover 24.5% (20% cash plus stamp duty and legal fees) of the price of the private property.

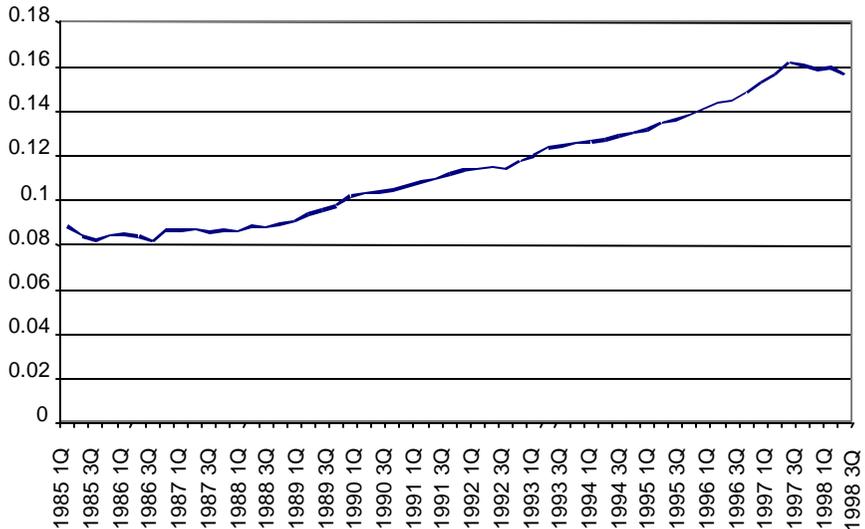
The housing stock of public housing in Singapore is much larger than that of private housing. However, the supply of private housing has increased at a higher rate in the 1990s compared to that of public housing. Figure 1 shows that the ratio of private to public housing stock has increased steadily since the mid 1980s (data compiled from URA statistics). The ratio turned down since 1997 due largely to the 1996 anti-speculation measures and the onset of the Asian economic crisis. The general upward trend in the ratio (increasing private housing stock) lends support to upgrading phenomenon in Singapore.⁶

³ CPF is a mandatory retirement saving scheme. Both the employer and employee contribute a percentage of the employee's salary towards the fund. However, part of the CPF fund can be withdrawn before retirement for the purchase of housing.

⁴ CPF money used for the purchase of residential properties has to be refunded, with interest, to the member's CPF account upon sale.

⁵ The anti-speculation measures were introduced to curb widespread speculation in the private property market.

⁶ We wish to thank a referee for this suggestion.

Figure 1: Ratio of Private to Public Housing Stock (1985-1998)

A Model of Threshold Affordability

Affordability refers to the ability of the upgrader to service the loan on the private property. Clearly, affordability depends on the upgrader's income and mortgage interest rate. Most loans in Singapore are adjustable rate mortgages. As mortgage rates change, the mortgagor's ability to service the loan would be affected. The affordability issue is more acute if income falls also, perhaps as a consequence of an economic slowdown.

The concept of threshold affordability is captured in the “**Threshold Buyer**” (Ong, 1998a). The *threshold buyer* is defined as a person or family who has to stretch to the limit to afford property ownership. This person has the cash to meet the statutory or legislative down-payment and has to borrow from a financial institution for the balance of the purchase price.

Suppose a potential buyer with an income Y_0 per month can afford to purchase a property worth P_0 at the prevailing mortgage interest rate i_0 if he/she takes a loan of $LV.P_0$ over n years, where LV is the loan-value ratio. The monthly mortgage payment will be $PMT_0 = LV.P_0.MC_{i_0,n,12}$ where $MC_{i,n,12}$ is the mortgage constant formula (monthly compounding). By definition, the monthly repayment is the maximum cash that the threshold buyer can afford to fork out each month for the property. The maximum cash

could be set by regulatory or institutional constraints, such as the bank's stipulated payment-income ratio, or personal financial needs. More precisely, we define $PMT_0 = dY_0$ where d is the stipulated payment-income ratio.⁷

Consider next the scenario that mortgage interest rate rose from i_0 to i_1 before the threshold buyer could purchase the property. The higher mortgage rate is not perceived to be temporary. At i_1 , it is clear that the threshold buyer can no longer afford the purchase price of P_0 if income stays unchanged. This is because at the higher interest rate, the monthly loan repayment will be $PMT_0 = LV \cdot P_0 \cdot MC_{i_1, n, 12}$. It is straightforward to note that $PMT_1 > PMT_0$ since $i_0 < i_1$. Given that PMT_0 is the maximum cash that the threshold buyer can afford each month, the property at P_0 is out of his/her reach now.

We further allow the threshold buyer's income to change to Y_1 when the mortgage rate changes, and assume that the loan-value and payment-income ratios remain unchanged after the rate increase. Keeping all other factors constant, it can be shown that the new private property price P_1 required to ensure that the threshold buyer would still to be able to afford the property purchase (we term this the *equivalence principle*) is:

$$P_1^A = \frac{Y_1}{Y_0} \frac{MC_{i_0, n, 12}}{MC_{i_1, n, 12}} P_0, \quad (1)$$

where $MC_{i, n, 12}$ is the mortgage constant formula for interest rate i over n years, monthly compounding, and $i_0 < i_1$. Even if CPF savings are utilized in the purchase of the private property, equation (1) still applies as long as the savings can be expressed as a percentage of the original private property price and the same percentage is utilized in the computation of the property price in subsequent periods.

The equivalence principle simply places the threshold buyer in an equivalent position where he is neither better nor worse off after the changes in income and mortgage rate.

Threshold Upgradability

The “**Threshold Upgrader**” is an owner of a HDB flat who is just able to upgrade to a private property *prior* to changes in the values of the HDB flat or private property. By this, we mean that the threshold upgrader is relying entirely or partially on the cash proceeds from the sale of the HDB flat to pay

⁷ Unlike other countries, Singapore banks do not use a house price to income ratio to measure affordability.

the minimum cash required to purchase the private property. In addition, the threshold upgrader can just barely afford the servicing of the mortgage for the private property.

In other words, the threshold upgrader's ability to repay the mortgage obligation is stretched to the limit allowed by the legislative framework in Singapore. The threshold upgrader's main concerns are (a) whether he or she can come up with the cash to purchase a private property and (b) whether he/she can afford the monthly mortgage installment payments. We can think of the threshold upgrader as a HDB flat owner who is just able to cross over the threshold of private property ownership.

For ease of exposition, we will assume that the upgrader needs the entire cash proceeds to meet the cash requirement to purchase a private property. However, even if the upgrader has other sources of funds, the following analysis will still apply as long as the upgrader partially relies on the net sale proceeds from the HDB flat.

A good example of the threshold upgrader is a flat owner who is able to upgrade to a condominium in a certain location one year ago, based on the prices back then. The threshold upgrader is able to upgrade only because he/she can use the net sale proceeds from the HDB flat to pay for the 20% minimum cash outlay as well as legal fees and stamp duty. However, for some reasons, he or she did not. Now, the value of the HDB flat has declined. As such, the threshold upgrader faces the question of whether he/she can still upgrade to *the same private property* given today's market values.

The answer can be stated in a simple rule: The threshold upgrader is still able to upgrade to the same private property if the magnitude of the change in the private property value is more than four times the magnitude of change in the price of the HDB flat. The equivalence principle applies again in that we ask what should be the property price to place the upgrader in a similar position after prices have changed over time.

This rule is obtained from an analysis of the cash flow needs. As stated earlier, in order for the threshold upgrader to purchase a private property, the current net sale proceed must be equal to the 20% deposit plus stamp duty and legal fees. A simple derivation will show that the decline in private property value should be more than the reciprocal of 24.5% multiplied by the fall in HDB flat value in order for the threshold upgrader to afford the same upgrade now. If we denote the percentage required cash outlay as q , then the change in private property price should be $1/q$ multiplied by the change in the price of HDB prices to enable the upgrader to be indifferent to the price

changes.

Formally, let us denote the private property price and HDB resale price at $t=0$ as P_0 and H_0 respectively. Further, MB is the mortgage balance and C is the CPF to be refunded. The threshold upgrader also has additional cash savings of S . The cash proceeds from selling the HDB flat is $H_0 - MB - C$. Since the threshold upgrader is barely able to afford a private property at P_0 , it must be that $qP_0 = H_0 - MB - C + S$.

At $t=1$, HDB resale prices have moved to H_1 . In order for the threshold upgrader to upgrade, the private property price must be P_1 such that

$$P_1^{RA} = \frac{(H_1 - H_0)}{q} + P_0. \quad (2)$$

For details, see Ong (1998b) and Ong and Sing (1999).

An Inter-temporal Model of Threshold Upward Mobility

Now we can formulate a model of upward mobility that incorporates the concepts of threshold affordability and upgradability. The threshold upgrader has to consider two concerns: the ability to afford the monthly mortgage payments and the cash outlay. As before, we appeal to the equivalence concept to compute the theoretical private housing price that places the threshold upgrader in an equivalent position in terms of affordability and cash outlay.

We denote the theoretical private property price at time t that allows the threshold upgrader to have sufficient cash outlay as P_t^{RA} , and the private property price that enables the threshold upgrader to afford the monthly installment payments at the prevailing mortgage rate (i_t) and income (Y_t) as P_t^A . P_t^A is computed as in equation (1) while P_t^{RA} is computed by equation (2). In order for the threshold upgrader to be no better or no worse off, the theoretical private property price (TPP) should be the lower of P_t^A and P_t^{RA} :

$$TPP_t = \min[P_t^{RA}, P_t^A] = \min \left[\frac{(H_t - H_{t-1})}{q} + P_{t-1}, \frac{Y_t}{Y_{t-1}} \frac{MC_{i_{t-1}, n, 12}}{MC_{i_t, n, 12}} P_{t-1} \right], \quad (3)$$

where P_t , H_t , Y_t and i_t are the private property price, public flat price, income and mortgage rate respectively, at time period t , MC is the mortgage constant and q is the percentage required cash outlay.

The minimum of the two threshold property prices is chosen because the

threshold upgrader is subject to two constraints - the constraint imposed by HDB resale flat prices and the installment payment constraint.

Empirical Methodology and Data

To provide support for the threshold upward mobility model, we first conduct an empirical analysis to evaluate if the demand-side variables postulated in the above model are significant determinants of private property prices. In this respect, we appeal to the work by Ng (1998) where he examines the effects of macro-economic factors on private property price in a cointegration-error correction framework. The macro-economic variables examined are GDP, mortgage rates and number of units completed. The innovation here is to include the prices of public housing as an independent variable.

Essentially, we first estimate a cointegrating relationship between the variables of interest (as in Ng, 1998). The cointegration methodology has been well established by Engle and Granger (1987) and Johansen (1988; 1991), and details are omitted here for brevity. Next, an error correction model is estimated to evaluate specifically the effect of changes in HDB price, mortgage rates and GDP on the change in private property price.⁸

We use the private residential property price index compiled by the Urban Redevelopment Authority (URA) to proxy for the prices of private properties. The URA residential property price index⁹ (denoted as *RPI*) is a transactions-based index available on a quarterly basis. The HDB resale price index is used to proxy for the value of HDB resale flats. The HDB resale price index (denoted as *HDB*) is also based on transactions of HDB resale flats, compiled by HDB on a quarterly basis. The first available data for the HDB resale price index is 1Q 1990.

Income is proxied by the Gross Domestic Product (*GDP*) and the mortgage rate (*MR*) is that charged by finance companies for 15-year maturity loans. The mortgage constant is computed for 15 years ($n=15$) to maintain consistency with the mortgage rate used. End-of-period mortgage rates are used.¹⁰

⁸ This is a reduced form model and not a structural model. We wish to thank a referee for pointing this out.

⁹ The URA index is the most widely used real estate index in Singapore. It is based on contract dates of transactions, not the transfer dates.

¹⁰ Although the end-of-quarter mortgage rates are used here, the results remain the same

The number of private residential units completed (*CUNITS*) is obtained from URA publications. The data from 1Q 1990 through 4Q 1998 is summarized in Table 1. All variables are stationary after the first difference (results not reported, but available on request), and this result is consistent with earlier works (Ng, 1998).

Table 1: Summary Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
<i>HDB</i> (index)	227.28	111.49	98.70	406.20
<i>RPI</i> (index)	199.52	75.37	97.80	314.60
<i>GDP</i> (\$million)	23490.19	4658.20	16311.90	30540.60
<i>MR</i> (%)	7.01	.4959	6.22	8.27
<i>CUNITS</i> (units)	1866	1046	498	4400
<i>TPP</i> (index)	195.66	79.54	89.97	339.21
<i>DHDB</i> (%)	3.43	7.43	-7.24	31.32
<i>DRPI</i> (%)	1.79	6.22	-13.12	13.94
<i>DGDP</i> (%)	1.68	2.68	-3.19	6.48
<i>DUNITS</i> (%)	8.49	30.82	-52.66	85.34

Note: All variables are quarterly figures from 1Q 1990 through 4Q 1998. The variables are *HDB* resale price index (*HDB*), private residential property price index (*RPI*), Gross Development Product (*GDP*), mortgage rate (*MR*), completed private residential units (*CUNITS*) and theoretical property price (*TPP*). A *D*-prefix indicates the percentage change.

The cointegration regression is

$$RPI_t = a_0 + a_1 HDB_t + a_2 GDP_t + a_3 MR_t + a_4 CUNITS_t + e_t, \quad (4)$$

and the error correction model is

$$DRPI_t = b_0 + b_1 \hat{e}_{t-1} + b_2 DHDB_t + b_3 DGDP_t + b_4 DMR_t + b_5 DUNITS_t + n_t. \quad (5)$$

The *D*-prefix represents the first difference of the variables and \hat{e}_{t-1} is the error correction term, i.e., the lagged residual estimated from equation (4). Although the independent variables in equation (5) are contemporaneous, various lags were tested. Ng (1998), for instance, found that the first lag in *DMR*, third lag in *DGDP* and the second and third lags in *DUNITS* were significant.

The above variables are also used to compute the theoretical private property

when average of three months or mid-quarter mortgage rates are used.

price under the upward mobility model. Prior to the anti-speculation measures introduced in May 1996 the cash outlay is 11.5% of the property price. As such, the theoretical property price in equation (3) was computed by setting $q=0.115$ if t is on or before 2Q 1996. After 2Q 1996, $q=0.245$

Empirical Results and Prediction

Table 2 shows the estimated cointegrating relation and that all four postulated factors are statistically significant in explaining *RPI*. The coefficients on all factors are of the expected signs. A negative coefficient is estimated for the mortgage rate variable since an increase in mortgage rates leads to a fall in private property prices. In contrast, the coefficients for *GDP* and *HDB* are positive since an increase in income and the value of the HDB flat enhances affordability and upgradability. The coefficient for *CUNIT* is negative as an increase in the supply of private residential properties is expected to depress private property prices.

Table 2: Cointegration Regression for Private Residential Property Prices

Variable	Coefficient	Standard Error	t-ratio
Constant	69.379	70.002	.920
HDB _t	.4077*	.1270	3.208
GDP _t	.0129*	.0037	3.541
MR _t	-27.1419*	9.5423	-2.844
CUNITS _t	-.0377*	.0085	-4.439

Note: Dependent variable is the private property price index (*RPI*), independent variables are the HDB resale price index (*HDB*), *GDP* (*GDP*), mortgage rate (*MR*) and completed private residential units (*CUNITS*). $R^2 = 0.90919$.

* indicates significance at 5% level.

The error correction model is shown in Table 3.¹¹ The error correction term (lagged residual from equation (4)) is negative and significant, as expected. Interestingly, the contemporaneous change in public flat price (*DHDB*) and income (*DGDP*) are positive and significant, as postulated by our model. The change in mortgage rate (*DMR*) and change in completed private residential units (*DUNITS*) are not.¹² As an aside, it should be noted that evidence of cointegration and the estimated error correction model is not evidence of causality. In Ong and Sing (2001), it is empirically shown that public property

¹¹ Several lag structures were tested to maintain some consistency with Ng (1998). However, the reported model best explains the change in private property price.

¹² The fact that the difference in mortgage rates is not significant explanatory variable in the error correction model does not detract from the significance of mortgage rates in the cointegration regression (in levels).

prices do Granger-cause private property prices.

Table 3: Error Correction Model for Private Residential Property Price

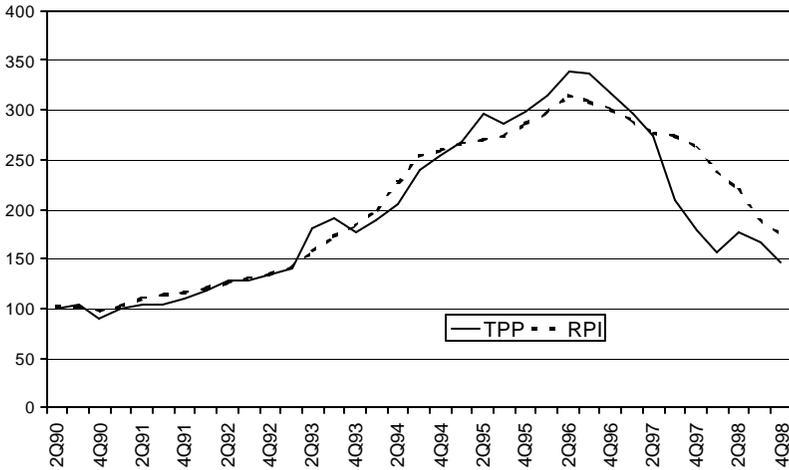
Variable	Coefficient	Standard Error	t-ratio
Constant	3.7240	2.4423	1.525
\hat{e}_{t-1}	-.0235*	.0114	-2.067
DHDB _t	.5034*	.1188	4.236
DGDP _t	.4710*	.1269	3.710
DMR _{t-1}	-.5826	.0493	-.118
DUNITS _t	.0292	.0271	1.076

Note: Dependent variable is the change in private property price index (DRPI), independent variables are the change in HDB resale price index (DHDB), GDP (DGDP), mortgage rate (DMR) and completed private residential units (DUNITS). \hat{e}_{t-1} is the error correction term. $R^2 = 0.9992$.

* indicates significance at 5% level.

Thus the results provide support for the underpinnings of the postulated models in that the hypothesized factors – HDB resale prices, income and mortgage rates – are significant explanatory factors for private property prices in Singapore. This is so after accounting for supply effects.

Next, the theoretical private property price (*TPP*) is computed from 1990 through end 1998 based on a one-period ahead basis. By this, we mean that the *TPP* for period $t+1$ is computed based on the private property index for period t . The *TPP* is shown in Figure 2. The actual residential property price index (*RPI*) is also shown for comparison. As seen, the *TPP* tracks the *RPI* rather well.

Figure 2: Theoretical (TPP) and Actual (RPI) Private Property

It is also apparent that the *TPP* tends to lead the *RPI*. For instance, in mid-1993, the *TPP* exhibited a sharp spike, and the *RPI* subsequently increased also. In mid-1996 with the onset of the anti-speculation measures, *TPP* started to decline before the fall in *RPI*. These observations will be further discussed in the section on Implications for Housing Policy.

The only notable deviation is from mid 1997. This can be attributed to the 1996 anti-speculation measures and the Asian economic crisis. *TPP* appears to be more sensitive to the shocks generated by the economic crisis as captured by the macro-economic variables and actual property prices take a longer time to respond.

To evaluate the goodness of the upward mobility model, we test how well the theoretical property price is able to predict the actual private property price. A regression using the *TPP* and *RPI* in levels would be spurious (Granger and Newbold, 1974), so we regress the change in private property price in period t against the difference between the theoretical property price in period t and the private property price in period $t-1$:

$$DRPI_t = a_0 + a_1(TPP_t - RPI_{t-1}) + \mathbf{x}_t.$$

(6)

The OLS regression in equation (6) is essentially a Thiel’s decomposition (1966). The slope coefficient a_1 (regression proportion) is expected to be insignificantly different from 1 for TPP to be a good predictor of RPI . Further, the intercept a_0 (bias proportion) should be insignificantly different from 0.

Table 4: Thiel’s Decomposition between Theoretical Property Price and Actual Private Property Price

Variable	Coefficient	Standard Error	t-ratio
Constant	5.2695	5.1609	1.021
$TPP_t - RPI_{t-1}$.9702	.0304	.981

Note: Dependent variable is the change in private property price index ($DRPI$). The independent variable is the difference in the theoretical private property price and the lagged private property price ($TPP_t - RPI_{t-1}$). The t-ratio tests the null hypotheses that the constant is zero and that the coefficient is one.

* indicates significance at 5% level.

The null hypotheses are that the constant is zero and that the coefficient is one. The results in Table 4 clearly show that the bias proportion is insignificantly different from zero and the slope coefficient is insignificantly different from one. As such, the empirical test demonstrates that the theoretical property price computed from the postulated model of threshold upward mobility is a good predictor of the actual private property price from 1990 through 1998.

Implications for Housing Policy

Several implications for housing policy can be drawn. First, this paper demonstrates that a public housing market that has an active secondary market can have important bearing on private housing prices. The link is essentially through affordability and upward mobility from public to private housing. The postulated model and empirical results clearly show that the prices of private housing are influenced by the resale prices of public flats, in addition to income and mortgage rates. The results of the above analysis can be extended to the study of upward mobility in general: the prices of properties in a better housing stratum depend, in part, on the price movements of properties in the lower housing stratum.

Second, the ability to upgrade from public to private housing depends to a large extent on legislative and financing regulations. For instance, the increase in cash outlay from 10% to 20% from May 1996 meant that HDB flat owners would find it harder to upgrade. The theoretical property price computed under our model shows a sharp decline in the second half of 1996

(see Figure 2). In fact, the theoretical price led actual private property price decline from mid-1996 through 1998. On a more general level, inter-stratum upward mobility depends critically on the legislative and financial framework.

Third, the increase in affordability and upward mobility in Singapore started in 1993. This can be attributed, in no small part, to the liberalization of housing financing policy for resale HDB flats. Prior to 1993, buyers of HDB flats from the secondary market can only finance their flats based on HDB listed prices that are substantially below the open market prices. From 1993 onwards, financing can be obtained based on the open market prices, subject to HDB valuation. The change in financing policy considerably enhanced affordability and contributed to the strong property market performance from 1993 to 1996. The implication is that the entire stratum in the housing market is inter-related. Changes in policies that affect one stratum could have far fetching impact on housing in general.

Conclusion

This paper provides the theoretical underpinnings to construct an inter-temporal model of affordability and upward mobility for private housing ownership using the Singapore experience as a case study. The model takes into consideration the legislative and financing framework and is based on cash flow needs for the purchase of private housing. The resale price of the HDB flats is an important factor, in that the proceeds from the resale of the HDB flats are used for the cash outlay to purchase a private property. The fact that Singapore has two active housing markets – the public and private housing markets – meant that a clean analysis of affordability and upward mobility could be made.

The threshold upward mobility model essentially computes the theoretical private property price as the lower of threshold affordability price as a result of changes in income and mortgage rates, and threshold upgradability price as a result of changes in the value of the resale HDB flats. The empirical analysis supports the proposed model in that mortgage rates, HDB resale prices and income are significant variables in explaining the change in private property prices, even after accounting for supply effects. Moreover, the theoretical property price computed under the model is a good predictor of the actual private property price from 1990 through 1998.

Although the model is constructed from the Singapore housing experience, valuable lessons can be learnt for upward mobility between housing stratum

in other countries as well. However, it should be reiterated that the legislative and financing environment for property purchase plays a crucial role in the ability of public housing owners to upgrade. As such, a financial cash-flow motivated analysis of the affordability and upward mobility issue is pertinent.

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