The Anatomy of a Housing Bubble[†]

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(Incomplete. For discussion and criticism only.)

Abstract: This paper studies the upswing in the Hong Kong residential housing prices during the mid-1990s. The market-wide index (CentaCity Index) experienced a real increase of 50 percent from 1995 to 1997, followed by a real decrease of 57 percent from 1997 to 2002. Using a panel data set of over 200 large-scale housing complexes (estates), this episode is explored in a cross-sectional manner. Dramatic increases in transaction volume during the price upswing and cross-sectional variation in the price behaviour are documented. To explain the price and volume movements under a unified framework, an application of a speculation model (Scheinkman & Xiong 2003) is put forward. The data give strong support for speculative activities fuelling the price upswing. While media reporting does not seem to have promoted the price upswing, uncertainties about the political future of Hong Kong around the Handover are likely to have played a role.

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1. Introduction

Housing bubbles have long been a subject of debate. There is not yet consensus on what constitutes a bubble, whether they exist, and how to distinguish, especially before a price downturn is observed, rational price increases from non-fundamental price movements. It is often difficult to measure the fundamental value of assets. The uniqueness of each property, the intricacy of local demand and supply conditions and regulatory environment and the lack of long and high-quality time-series housing data add to the challenge of identifying a housing bubble. At the same time, deviation of housing prices from observables, increases in turnover volume in hot markets and the large variation of price trends among cities pose a challenge to explaining housing price movements with standard asset pricing theories (Case & Shiller 2003).

This paper proposes an application of a speculation model (Scheinkman & Xiong 2003; speculation model henceforth) as a test of non-fundamental housing price movements.[1] This provides a unified framework under which speculative trading arises in a market with overconfident investors when there is heterogeneity in beliefs regarding fundamentals, leading to higher turnover rates and cross-sectional variation in the extent of price increases. The main assumptions of the model, including short-sale constraints and the dominance of individual inexperienced market players, apply well to housing markets.[2] While Keynes has long ago emphasized the importance of animal spirits in determining asset prices, this paper is the first to test for speculative activities in the

[1] Harrison and Kreps (1978) first propose the speculation model where hetereogeneous beliefs generate a non-fundamental price component equal to the option value for resale. Scheinkman and Xiong (2003) solve the model in continuous time using overconfidence as a source of belief heterogeneity and show that bubbles can form even with transactions costs.

[2] In related work, Mei, Scheinkman and Xiong (2004) and Hong, Scheinkman and Xiong (2005) offer evidence that overconfidence-driven speculation explains an important part of the non-fundamental price component in foreign-share prices and dotcom-era stock prices.

housing market with a formal economic mechanism to motivate expectations of future gains that are not justified by fundamentals. It also contributes to the continuing debate on whether non-fundamental factors or psychology plays a significant role in asset markets.

Another innovation of this paper is its focus on the cross-sectional differences in price movements in a geographically small but active housing market, by utilizing a unique panel data set of residential housing prices in Hong Kong during 1992-1998. A within-city analysis enables one to abstract from the complexity of macroeconomic dynamics, including international trade and capital flow patterns. It also circumvents the comparability problem in cross-city studies. The Hong Kong residential market is of interest in itself, with a real price increase of 50 percent from 1995 to 1997, followed by a real decrease of 57 percent from 1997 to 2002 (Figure 1).

To apply the speculation model to the Hong Kong residential market, housing prices are compared to an extensive array of fundamentals, identifying a potential price bubble during 1995-1997. Next, cross-sectional variation in the size of price upswing is documented, highlighting the incompleteness of macroeconomic explanations. Finally, the positive correlation between the speculative price component and turnover volume implied by the speculation model is tested for, controlling for confounding factors such as liquidity trading.[3] I performed the test both during and outside the potential bubble period, to probe whether the test can effectively differentiate between speculation and non-speculation. I also offer some tentative evidence of land supply conditions as a source of heterogeneity in beliefs.

[3] The other testable implication relies on asset float, which is not directly applicable to housing markets.

Although the price upswing took place during a tumultuous time of Hong Kong history, many of the macroeconomic variables turn out to have been surprisingly stable. Steady trends in the housing stock, public sector housing provision and land sales rule out a simple supply-side story in which a sudden decrease in housing supply or rational expectations of future supply decreases caused the observed price increases. An investigation into population growth and migration, real wages, real interest rates and tax structure discounts the relevance of increases in the consumption component of housing demand. A comparison with the returns of various investment vehicles, including the Hong Kong stock market sub-indices and foreign stock market indices, does not give support to the "flight to quality" investment demand story.

Considerable cross-sectional variation is found in the size of the price upswing during 1995-1997.[4] Alternative explanations for cross-sectional variation in price increases are considered in Section 4, showing that the variation is not solely due to aggregation or liquidity trading. The size of Hong Kong (1102 sq. km., about six times the area of Washington DC) and perfect mobility within the territory imply that different parts of Hong Kong share the same pool of buyers.[5] This means that any macro explanation is unlikely to account for the cross-sectional variation.

Using the number of no-trade months as a proxy for liquidity, I identify a robust price-turnover correlation during the potential bubble period (Oct 1995- Sept 1997). No

[4] The inter-quartile range of price movements (using average prices in 1992 as baseline) is 39.6 percentage points in 1997, compared to 27.6 in 1995. The same measure on the trough-to-peak increase in quarterly prices from 1995 to 1997 is equal to 23 percentage points.

[5] From the 2002 Census, about 30% of the working population in Hong Kong travel out of their districts of residence for work. More than 60% of the students commute out of the district to school. Hong Kong is divided into 18 districts.

similar correlation is found during the comparison period, July 1993- June1995. In addition, estate characteristics and district fixed effects are controlled for.

This paper is organized as follows: the next section describes the data, Section 3 provides an analysis of the fundamental economic factors, Section 4 presents the cross-sectional variation in the price upswing, Section 5 outlines the speculation model and presents the empirical results, and Section 6 offers concluding remarks and direction for future work.

2. Data

The residential housing index, which is used to describe market-wide trends, is publicly available. Measures of housing price determinants, including housing stock, construction cost, population growth and interest rates, are obtained from various sources (see Appendix for details).

Raw transaction data were obtained for all real estate transactions in Hong Kong during the period 1992-1998.[6] After discarding transactions for the non-residential sectors and non-liveable space (e.g., car parks), there are 349,149 property-level observations with the settlement price, square footage, building name and street address.

A large proportion of the Hong Kong population live in large-scale housing complexes, called estates. These estates consist of many blocks of almost identical units, and are spread across different geographical areas in the territory. Although there is no information on the unit characteristics (e.g., view and floor level) for each transaction, average prices within each estate should be a reasonable proxy for housing values of any

[6] Tsur Sommerville kindly provides this data, which also covers part of years 1991-1993.

unit in that estate, provided that transactions are frequent.[7] To focus on the large-scale housing estates with frequent transactions, 400 estates with a total transaction higher than 400 are included in my sample. As Figure 2a shows, not only do these 400 housing estates account for 85 – 95 percent of all residential market transactions during 1992 – 1998, the movements in turnover for the 400 estates track the overall market trend.

To eliminate effects of primary market sales, only estates built before 1993 are included. Labelling errors in the original data further reduce my sample size to 324 housing estates and a total of 19,044 property transactions.

The top and bottom 1 percent of (per square foot) price observations of each housing estate are discarded. Two panel data sets are created using the truncated price series, at monthly and quarterly frequencies, by averaging per square foot prices within each estate and month (or quarter). Results using the monthly price series are presented in this paper, but the quarterly data series provides a sanity check.

Non time-variant characteristics are hand-collected for close to 300 estates. Table 1 illustrates the considerable variations among the estates in my sample in different dimensions.

3. An Analysis of the Fundamentals

The residential housing price index shows a dramatic upward trend around 1995, followed by a sharp downfall around 1997.[8] Figure 4 to 13 explore whether there were similar movements in the supply and demand conditions. Because the effects of the fundamentals and speculation are not mutually exclusive, it is important to examine the

[7] Units of different types or quality within an estate being sold seasonally also creates a bias in measuring movements in the true housing value. Wong (2005) documents the high correlation between averaged raw transaction prices and hedonic-adjusted transaction prices for 44 prominent housing estates in Hong Kong.
[8] Figure 1. The index is deflated using the food price index.

macroeconomic conditions. At the same time, it is worth keeping in mind that the economic trends considered in this section are unlikely to explain any cross-sectional variation in the price upswing.

The housing stock in Hong Kong has been growing at a remarkably smooth rate, and the share of housing units provided by the government has remained slightly less 50 percent since 1987 (Figures 4 & 5). Construction costs also shows no significant movement during the past decade (Figure 6).

On consumption demand, Figures 7 to 9 illustrate stable trends in population, wages and home ownership rate. Interestingly, returns to the non-real estate components in the Hang Seng Index were at least as high as that to holding the residential housing stock (Figure 9), which rules out a "flight to quality" explanation. Figure 10 compares movements in Hong Kong housing prices with those in the stock markets in Singapore and Japan. While all three experienced a downturn between 1996 and 1998, the foreign stock market indices fell much earlier than Hong Kong housing prices, and they did not show the sharp upward movement before the fall. While the housing market collapse might have been caused or aggravated by the regional economic downturn, this suggests that the upswing before 1997 was due to factors more specific to Hong Kong.

Because of the Hong Kong dollar peg to the US dollar since 1983, the Best Lending Rate (prime rate) often relates more to the economic conditions in the United States than to those in Hong Kong. The correlation between the monthly averages of housing prices and that of the (inflation-adjusted) prime rate shown in Figure 12 is 0.51 during 1992-1997, and 0.58 during 1992-2004. There is little evidence that lower interest rates fuelled the housing boom.

Most residential rental leases are not required to register with the Land Registry, provided that they last for less than 3 years. The Ratings and Valuation Department, however, publishes detailed time-series data of rental prices in Hong Kong. Under the standard asset pricing model, housing prices are equal to the expected net present value of the housing service flow (Poterba 1984). Homeowners equalize the marginal costs and marginal benefits of housing services, such that optimism in the market about future returns affects the relationship between current sale prices and rental rates. To express this more precisely, the asset market equilibrium condition implies that the real rental price is equal to the difference between per-period opportunity cost of housing services and expected capital gains:

$$\dot{Q} = -R(H) + \nu Q, \tag{1}$$

where Q represents real housing prices, R rental price, H housing stock and ν the per period user cost of housing services. ν depends on depreciation rate, interest rate, property and income tax rates and inflation. The price-rent ratio increases with the expected real house price inflation rate $\dot{Q}/Q$, and therefore serves as an indicator of market sentiments and discounting.

It is surprising how closes the price-rent ratio tracked the housing price index (Figure 13). This suggests that market beliefs about the future mirrored the price movements during that period.

4. Describing the Price Upswing

Exploiting a panel data set of over 200 housing estates, a within-city analysis is performed. Two characteristics of the 1995-1997 price upswing limit the extent to which it can be explained by a standard asset-pricing explanation in which movements

macroeconomic factors cause the price movements: the co-movements in transaction volume, and the cross-sectional variation in the price upswing.

Figure 2b plots the percentage change in transaction volume against that in prices. Apparently the dramatic price upswing was accompanied by even more dramatic increases in transaction volume.

Figure 3a compares the housing price changes relative to the 1992 baseline price level among housing estates across the years. While the housing estates experienced price changes in 1993 relative to the 1992 level by similar percentages, they diverged since 1995. The 1997 distribution of price increases flattened substantially and shifted to the right. Although estates with a higher baseline turnover appear to have a flatter distribution in 1997, the same pattern is still seen in the graph with estates of below-median turnover. Figure 3b plots the same variables by year and month, showing that the flattening of the distribution is not due to aggregation. This contradicts the notion that territory-wide factors such as government policies and local and regional economic conditions were the main drivers of the housing price movements. The correlation between the average price increase relative to the 1993 average and the standard deviation of the annual price average distribution for 1991-1998 is 92.16.

Figure 3c shows the variation in the trough-to-peak price increase. The density of housing estates peaks around a price upswing of 60 percent, but there were still considerable cross-sectional differences. In terms of timing, however, the majority of the estates hit the trough in 1995 and peaked in 1997 (Table 2). A satisfactory explanation for this phenomenon, therefore, needs to account for the relative uniformity in timing of the price upswing, but variance in its size.

To describe the physical characteristics correlated with the size of the price upswing, as defined by the trough-to-peak percentage change, OLS regressions are performed:

$$(2) \qquad \Delta P_i = \alpha + \beta X_i + \varepsilon_i,$$

where ΔP_i is the price change, α a constant term and X_i a group of time-invariant estate characteristics. ε_i is an error term. Note that the dependent variable is measured in dollars per square foot. I experienced with numerous estate characteristics, and Tables 3 and 4 present the statistically significant results. Baseline price and log (estate-level average) flat size have the most stable relationship with the size of price upswing. This is compatible with findings in Case and Mayer (1996).[9] Estates with more spacious units are associated with larger price upswings, both within and across districts.[10] The size of the unit and travel time to city centres might be expected to correlate with the desirability of the estate in opposite directions, which is consistent with the signs of the related coefficients.[11] Taller buildings also seem to have experienced larger upswings, and columns (3) to (5) demonstrate that this is not driven by the other size aspects of the housing estate.

5. Testing a Model of Speculation

The appeal of the speculation model in Scheinkman and Xiong (2003) is several-fold. First, it relates price movements and transaction volume explicitly. Second, it is capable of explaining cross-sectional variation in the size of the speculative component. Third, there are directly testable implications of the model. The model explains

[9] All results reported in this paper remain quantitatively and qualitatively identical regardless of the choice of baseline year (1992 vs. 1993). Regressions using year 1993 as baseline are available upon request.
[10] Hong Kong consists of 18 districts.
[11] The average standard deviation in travel time to city centres among estates in the same district is less than 4 minutes, however, which limits the economic significance of the correlation.

speculation as a result of overconfidence, the belief that one's opinion is more precise than it in fact is. This model provides a framework in a continuous-time equilibrium where a non-zero speculative, or non-fundamental, price component results from the heterogeneity in beliefs. Differences in volatility of beliefs and the fundamental uncertainty associated with the asset lead to variation in the extent of speculation.

One explicit implication of the model is a positive cross-sectional relationship between the size of the speculative price component and the turnover rate. Empirically, this relationship is emphasized in this paper. To test for alternative theories predicting the same positive correlation between speculation and turnover, I control for liquidity, following the approach in Mei, Scheinkman and Xiong (2004). Moreover, the correlation is assessed both in and out of the "speculative period", which is defined as the period during which at least 100 estates were at a point between their trough and peak prices. If the positive correlation is mainly due to speculation, one expects to see a stronger and more significant relationship during the speculative period. On the other hand, if the positive correlation is caused by liquidity premium and other non-speculative factors, it should remains more or less constant in and out of the speculative period.

The following estimation provides a first pass:

$$(3) \qquad \Delta P_{it} = \alpha + \beta V_{it} + X_i + Y_t + Q_q + \varepsilon_{it},$$

where ΔP_{it} is the percentage change in prices at estate *i* during month *t*, relative to the trough price level of estate *i*. α is a constant term and V_{it} is the log turnover rate at estate *i* during month *t*. X_i, Y_t and Q_q are estate, year and quarter fixed effects respectively. ε_{it} is an error term. Table 4 shows a stronger and more robust correlation between price movements and turnover rate within the speculative as compared to the non-speculative

period. To the extent that the estate-specific liquidity premium is non time-variant, these results also suggest that liquidity cannot fully explain the observed correlation.

To allow for heterogeneity in the speculative price component-turnover correlation, and to sidestep the persistence in turnover rates, a cross-sectional regression is run separately for each month T, both inside and outside the speculative period:

$$(4) \qquad \Delta P_{it} = \alpha + \beta V_{it} + L_i + \theta X_i + D_i + \varepsilon_{it},$$

where ΔP_{it} and V_{it} are defined as before, L_i is the number of no-trade months in 1992 as a measure of illiquidity, X_i time-invariant estate characteristics and D_i a set of district dummies. ε_{it} is an error term. Results and Fama-MacBeth standard errors from regressions for the 24 months during the speculative period are reported in Table 5.

The price movement-turnover rate correlation remains positive and robust in all specifications. Column (7) shows the most sophisticated model with various estate characteristics and district dummies. This contrasts with the unstable and non-robust correlation in Table 6, which reports the results from 24 months outside the speculative period.

The illiquidity indicator (number of no-trade months) has a negative correlation with price movements as expected. With the exception of estate-level average flat size, other estate characteristics have different relationships with price movements inside and out of the speculative period. This is suggestive of differences in price trends among various types of estates, unrelated to speculation.

6. Media reporting

It has been suggested that the hype generated by media reporting of home price movements has a positive impact on the spread of speculative activities (e.g., Shiller). To

investigate whether this was true, the number of articles in South China Morning Post, the main business newspaper in Hong Kong, relating specific housing estates and issues related to the property market is counted for each housing estate during the period of 1992-1998. The number of words in each article is also recorded.

Table 7 reports the differential in the price-volume correlation by the amount of media attention. Regression (4) is run separately for estates with media attention indicators above or below the sample medians. Median measures of the three indicators, the article count, the word count and the number of words per article, divide the estate sample in the same way. Panel A reports the coefficient and standard errors of the log turnover variable. The first row demonstrate that during the speculative period, much of the price-volume correlation is driven by estates with below-median media attention before the period. Outside the speculative period, a comparable phenomenon is also seen: below-median median attention is related to more positive price-volume correlation. This points to the media as an information provider, reducing market disagreement. Similar results are shown in Panel B, use the 95 percentile as the cut-off instead.

7. 1994 District Board Elections

The first directly elected District Boards (DBs) were formed in September 1994. DB membership is made up of one member per constituency, approximately one for each 17,000 population. Previously the DBs were two-thirds directly elected; Appendix 2 details the evolution of the institution. They form the most local level of the government, and are designed to assist the central Hong Kong government departments in formulating policies with local concerns. In particular, local zoning regulations are devised with consultation with the DBs.

One main controversy around the time of the September 1994 election was the Mainland China government's threat to invalidate the directly elected DBs after the Handover, and replace them with appointed boards. (The elected DBs in 1994 were eventually dissolved after the Handover. "Provisional District Boards" were put in place, with all members appointed.)

At the time of the 1994 election, two things were uncertain: how many of the elected members would be replaced and who they would be replaced with. Presumably an invalidation of the directly elected DBs was to substitute candidates that were more acceptable to the new Hong Kong government after the Handover, or those closer to its political ideology, for members who had dissenting views against its policies. Data on all contestants of the 1994 election are collected, and estates matched to their respective district and constituency. DB election contestants are then classified on a five-point scale according to their political affiliation, five being the most Pro-China. The more Pro-China the 1994 elected members in a local constituency were, the less the local population should be uncertain about the future. Twenty-four months before the speculative period and the 1994 election form a control group. Table 8 shows the results.

Comparing the first two columns in Panel A, the more Pro-China the 1994 DB membership was in the district that the estate belongs to, the smaller price-volume correlation during the speculative period is observed. This is consistent with political uncertainties around the future of the DBs were related to the heterogeneous beliefs that caused the housing bubble. No such relationship is supported by data outside the speculation period and before the election took place. The first two columns of Panel B show the same results, using the constituency-level election data and controlling for

district fixed effects. Columns 3 and 4 suggest that during the speculative period, the leaning of the own-constituency DB member had an independent effect from that of the district-average leaning, despite in the same direction.

A "demo" dummy is defined as equal to one if the elected DB member in a constituency beat contestants who were more Pro-China on average. If the election was uncontested, the dummy also takes a value of zero. The district-level "demo proportion" is defined as a weighted (by number of registered voters) average of the demo dummies. Interestingly, columns 3 and 4 of Panel A present a significant variation in the price-volume correlation by the "demo proportion". Controlling for the leaning of the elected member, the more constituencies in the district had a contested election that was won by the Pro-China contestant, the higher the price-volume correlation is. This can be explained by the "demo" variable capturing expectations of a higher number of DB members to be replaced after the Handover, thus increasing the uncertainties.

Columns 5 and 6 explore this issue at the constituency level. Surprisingly, while the district "demo" average still shows a positive correlation with the price-volume correlation, the constituency-level measure takes on the opposite sign.

8. Concluding Remarks

From the Tulip Craze in the Netherlands in the 17th Century to the Technology Stock Bubble in the United States in the late 1990s, the classical view of asset pricing has been challenged. The literature of speculation has been limited by the difficulty of measuring fundamental values of assets. This difficulty is exacerbated in housing studies because of the structural heterogeneity of the housing stock, low transaction frequency, and the importance of geographical location and local institutions (e.g., zoning laws) in

determining housing values. This paper sidesteps these problems by performing a within-city analysis using a unique panel data set of over 200 large-scale housing complexes in Hong Kong.

The residential housing market in Hong Kong displayed unusual price behaviour during the 1990s. Not only did we see dramatic price increases followed by sharp downfalls, a careful look also reveals co-movements in turnover rates and considerable cross-sectional variation in price movements. A metropolitan city with homeownership at 50 percent, well-developed capital markets and low information cost within the territory, Hong Kong is not unlike many major cities in other parts of the world.

The panel structure of the data set enables the inclusion of various important controls and a comparison of the speculative and non-speculative periods. The value of the within-city analysis also derives from the ability to abstract from the macroeconomic conditions and institutional factors, which are often complicated and hard to measure.

While this paper does not assert the unimportance of the fundamentals during the upswing, it does show that they are unlikely to be the complete story. The debate over the existence of a non-fundamental price component in asset prices has long been heated, and there is an often-asked question as to whether certain housing markets experienced or are experiencing a "bubble". This paper provides support for the overconfidence-generated speculation model as proposed by Scheinkman & Xiong (2003). While there is no strong evidence that media hype promoted the housing price increase, uncertainties about the future political arrangements of the local government correlate with the price upswing. The understanding of speculation can be furthered by exploring the land supply conditions within cities as a source of uncertainties. Both natural and manmade

conditions, such as topography and re-zoning restrictions, might be related to the heterogeneity in beliefs.

While my results suggest the possibility of effectively using the speculation model as a diagnostic tool, this paper is based on the experience on one metropolitan city only. For a better understanding of the model's applicability on housing markets, more research needs to be done on assessing at what stage of development a bubble can be detected using this analysis.

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Table 1: Summary Statistics

Estate Characteristics	Mean	Std. Dev.	Obs
Age	18	5	299
Total no. of flats	370	644	299
No. of blocks	21	142	299
No. of stories	25	8	299
Flat per floor	3	5	299
Avg. flat size (sq. ft.)	583	304	289
Travel time to city centres (hour)	0.5	0.3	247
Turnover rate (%) -- pre-upswing	9	19	992
Turnover rate (%) -- post-upswing	14	27	992
Avg. price (constant USD per sq. ft.) -- pre-upswing	767	277	992
Avg. price (constant USD per sq. ft.) -- post-upswing	992	441	992

	Mean	Std. Dev.
1991-1995		
No. of articles per year	0.57	2.86
No. of articles per flat per year	0.005	0.02
No. of words per year	235.45	1230.28
No. of words per flat per year	1.99	10.08
1996-1998		
No. of articles per year	0.46	2.02
No. of articles per flat per year	0.004	0.017
No. of words per year	164.04	729.2
No. of words per flat per year	1.22	5.65

1994 DB elections	Mean	Std. Dev.
District-level		
Average Pro-China index	2.28	0.41
Voting rate	28.94	7.06
Demo proportion	0.22	0.12
Constituency-level		
Average Pro-China index	2.73	0.71
Voting rate	30.80	7.04
Demo dummy	0.20	0.40

Table 2: Timing of the Upswing

	Peak			
Trough	1996	1997	1998	*Total*
1994	0	25	0	25
1995	0	214	2	216
1996	1	25	0	26
Total	1	264	2	**267**

Table 3: Description of the price upswing

Dependent Variable: Trough-Peak Increase in Per Square Foot Sales Prices (%), 1994-1998

	(1)	(2)	(3)	(4)	(5)
Log baseline price 1992	-34.288***	-14.449**	-14.257**	-14.182**	-14.143**
	(5.858)	(6.638)	(6.790)	(6.763)	(6.795)
Log no. of floors	5.362	7.930***	--	--	--
	(2.726)	(2.735)			
Log travel time	-2.998	-5.591*	-4.290	-4.521	-4.336
	(1.883)	(3.173)	(3.221)	(3.208)	(3.224)
Log age	-7.682*	-2.179	-4.575	-4.551	-4.300
	(4.342)	(4.398)	(4.597)	(4.501)	(4.601)
Log flat size	23.681***	17.843***	14.941***	16.784***	15.777***
	(2.974)	(2.855)	(3.199)	(2.882)	(2.940)
Log no. of flats per floor	--	--	-1.011	--	--
			(1.160)		
Log population	--	--	--	1.543	--
				(1.108)	
Log no. of blocks	--	--	--	--	0.780
					(1.259)
District Dummies	No	Yes	Yes	Yes	Yes
Adj. R2	0.266	0.486	0.463	0.467	0.462

Table 4: Description of the price upswing

Dependent Variable: Trough-Peak Increase in Per Square Foot Sales Prices (%), 1994-1998					
	(1)	(2)	(3)	(4)	(5)
Log baseline price 1993	-38.949***	-17.643***	-16.883**	-16.593**	-16.473**
	(4.690)	(6.661)	(6.804)	(6.770)	(6.804)
Log no. of floors	8.263***	7.847***	--	--	--
	(2.543)	(2.570)			
Log travel time	-6.794***	-6.818**	-5.556*	-5.998*	-5.672*
	(1.797)	(3.010)	(3.053)	(3.048)	(3.057)
Log age	-10.458***	-4.538	-6.827	-6.563	-6.388
	(3.973)	(4.488)	(4.708)	(4.622)	(4.713)
Log flat size	29.106***	20.360***	16.833***	19.169***	17.921***
	(2.987)	(3.081)	(3.317)	(3.107)	(3.133)
Log no. of flats per floor	--	--	-1.419	--	--
			(1.111)		
Log population	--	--	--	1.654	--
				(1.052)	
Log no. of blocks	--	--	--	--	1.092
					(1.211)
District Dummies	No	Yes	Yes	Yes	Yes
Adj. R2	0.347	0.520	0.500	0.503	0.498

Table 4A: Pooled Panel Regression of Price Movements on Turnover Rates

	Dep Var: % Monthly Price change relative to trough			
	Speculative period		**Non-speculative**	
	(1)	(2)	(3)	(4)
Log turnover	22.875***	1.952***	2.823***	-0.072
	(0.933)	(0.709)	(0.750)	(0.447)
Estate fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	No	Yes	No	Yes
Quarter fixed effects	No	Yes	No	Yes
Adj. R2	0.265	0.853	0.049	0.700
No. of obs	6,736	6,736	12,485	14,056

Table 5: Correlation between Price Movements and Turnover Rate during the Speculative Period

1995 Oct - 1997 Sept (T=24)

	Dep Var: % Price change relative to trough						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log turnover	1.776***	1.718***	1.745***	1.837***	2.290***	1.610***	1.864***
	(0.418)	(0.404)	(0.406)	(0.392)	(0.422)	(0.295)	(0.321)
No-trade mths 1992	--	-0.111***	--	-0.601***	--	-0.388***	--
		(0.039)		(0.103)		(0.068)	
No-trade months 1993	--	--	-0.038	--	-0.658***	--	0.368***
			(0.056)		(0.127)		(0.081)
Log baseline p 1992	--	--	--	-12.178***	--	-6.269***	--
				(3.896)		(2.231)	
Log baseline price 1993	--	--	--	--	-17.322***	--	-8.706***
					(4.991)		(2.808)
Log no. of floors	--	--	--	2.026***	3.008***	2.078***	1.869***
				(0.461)	(0.560)	(0.478)	(0.438)
Log travel time	--	--	--	0.118	-1.884***	0.445	-0.285
				(0.349)	(0.321)	(0.615)	(0.483)
Log age	--	--	--	0.106	-1.545	2.230***	0.576
				(0.601)	(0.679)	(0.689)	(0.572)
Log flat size	--	--	--	9.756***	12.609***	10.421***	11.266***
				(1.448)	(2.062)	(1.600)	(1.862)
District Dummies	No	No	No	No	No	Yes	Yes
Adj. R2	0.026	0.029	0.029	0.202	0.245	0.384	0.362
No. of observations	250	250	250	180	197	180	197

Table 6: Correlation between Price Movements and Turnover Rate during the Speculative Period

1993 July - 1995 July (T=24)

	Dep Var: % Price change relative to trough						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log turnover	-0.058	-0.089	-0.077	-0.571***	-0.354***	-0.523***	-0.377***
	(0.180)	(0.176)	(0.179)	(0.135)	(0.143)	(0.109)	(0.128)
No-trade mths 1992	--	-0.031	--	-0.221***	--	-0.200***	--
		(0.054)		(0.053)		(0.045)	
No-trade months 1993	--	--	-0.157**	--	-0.166***	--	-0.157***
			(0.074)		(0.044)		(0.052)
Log baseline p 1992	--	--	--	12.495***	--	7.702***	--
				(2.536)		(1.991)	
Log baseline price 1993	--	--	--	--	11.766***	--	8.829***
					(2.066)		(1.881)
Log no. of floors	--	--	--	-1.322***	-1.506***	-0.129	-1.152***
				(0.441)	(0.398)	(0.425)	(0.339)
Log travel time	--	--	--	-0.084	0.438*	-0.967*	-0.608
				(0.229)	(0.231)	(0.523)	(0.488)
Log age	--	--	--	-3.750***	-4.088***	-5.962***	-5.204***
				(0.787)	(0.786)	(0.787)	(0.771)
Log flat size	--	--	--	3.756***	2.812***	4.426***	3.505***
				(0.654)	(0.629)	(0.780)	(0.781)
District Dummies	No	No	No	No	No	Yes	Yes
Adj. R2	0.026	0.010	0.029	0.236	0.262	0.384	0.328

Table 7: Media Reporting and Speculation

Panel A: Comparing estates with above and below median media attention

	No. of articles per flat[†]		No. of words per flat		Words per article	
Sample period	Above	Below	Above	Below	Above	Below
Speculative	-1.373	0.823***	-1.373	0.823***	-1.373	0.823***
	(2.691)	(0.208)	(2.691)	(0.208)	(2.691)	(0.208)
Non-speculative	-1.662***	-0.280**	-1.662**	-0.280**	-1.662***	-0.280**
	(0.387)	(0.142)	(0.387)	(0.142)	(0.387)	(0.142)

Panel B: Comparing estates with above and below 95 percentile of media attention

	No. of articles per flat[†]		No. of words per flat		Words per article	
Sample period	Above	Below	Above	Below	Above	Below
Speculative	0.838	0.779***	1.090*	0.745***	0.817	0.914***
	(0.695)	(0.202)	(0.571)	(0.198)	(1.331)	(0.264)
Non-speculative	-3.505	-0.552***	-1.273	-0.545***	-0.887	-0.477***
	(4.211)	(0.125)	(5.228)	(0.126)	(0.616)	(0.131)

Table 8. 1994 Local Government Election Results and Speculation

Panel A: District-level analysis

	Speculative period (1)	Non-spec (2)	Speculative period (3)	Non-spec (4)
Log turnover	2.579***	-0.058	1.357***	-0.757***
	(0.559)	(0.727)	(0.667)	(3.341)
No. of no-trade months, 1992	-0.331***	-0.019	-0.336***	-0.009***
	(0.062)	(0.076)	(0.062)	(0.073)
Pro-China index (1=Least, 5=Most)	3.116***	0.793	2.891***	--
	(0.826)	(0.981)	(0.891)	
Pro-China index *turnover	-0.748***	-0.105	-0.625***	--
	(0.246)	(0.324)	(0.256)	
Demo proportion†	--	--	-8.404***	-4.669
			(2.795)	(2.515)
Demo proportion† *turnover	--	--	3.988***	2.129**
			(1.062)	(1.021)
Avg. no of obs	181	164	181	164
Avg. Adj R2	0.180	0.318	0.181	0.313

Note: Speculative period refers to Oct 1995 - Sept 1997 (24 months), non-spec 2 to Sept 1992 - Aug 1994 (24 months).
† Demo proportion is the proportion of constituencies where the elected member defeated contestants who were more Pro-China on average.

Panel B: Constituency-level analysis

	Speculative period (1)	Non-spec 1 (2)	Speculative period (3)	Non-spec (4)	Speculative period (5)	Non-spec (6)
Log turnover	1.529***	-0.280	4.450***	-0.358	-1.071**	0.006
	(0.453)	(0.622)	(0.975)	(2.503)	(0.505)	(1.133)
No. of no-trade months, 1992	-0.265***	0.074	-0.268***	0.012	-0.272***	0.039
	(0.067)	(0.125)	(0.066)	(0.120)	(0.069)	(0.122)
Pro-China index (1=Least, 5=Most)	2.036***	1.106**	1.948***	1.163**	1.550***	1.208**
	(0.305)	(0.547)	(0.310)	(0.561)	(0.258)	(0.575)
Pro-China index *turnover	-0.474***	-0.085	-0.419***	-0.123	-1.055	-0.619
	(0.114)	(0.214)	(0.118)	(0.229)	(3.510)	(3.141)
Dist pro-China index *turnover	--	--	-1.281***	0.054	--	--
			(0.467)	(1.095)		
Demo dummy†	--	--	--	--	-0.201*	-0.146
					(0.118)	(0.246)
Demo dummy *turnover	--	--	--	--	-2.709***	0.338
					(0.507)	(1.053)
Dist demo proportion *turnover	--	--	--	--	9.794***	-0.887
					(1.949)	(3.389)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Avg. no of obs	117	106	117	106	117	106
Avg. Adj R2	0.460	0.366	0.462	0.372	0.463	0.366

Note: Speculative period refers to Oct 1995 - Sept 1997 (24 months), Non-spec 1 refers to July 1993 - Jun 1994 and Non-spec 2 to Sept 1992 - Aug 1994.
† Demo dummy is equal to one if the elected member of the constituency defeated contestants who were more Pro-China on average.

Figure 1: Real housing price movements, 1992-2004

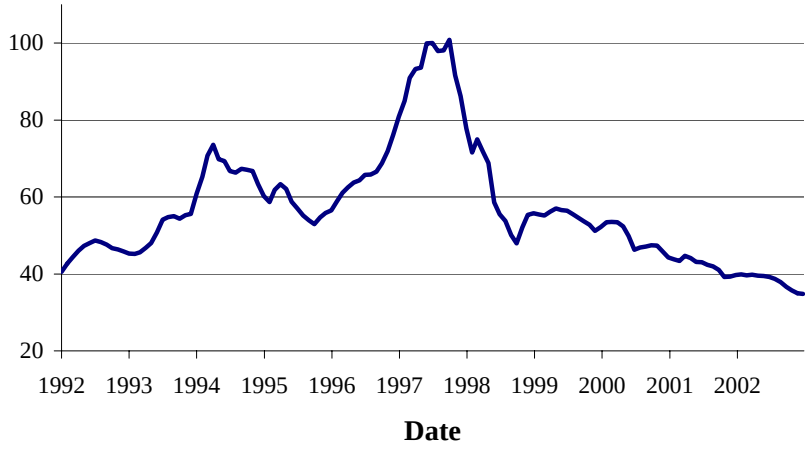


Figure 2a: Sample vs. Market Wide Transaction Volume

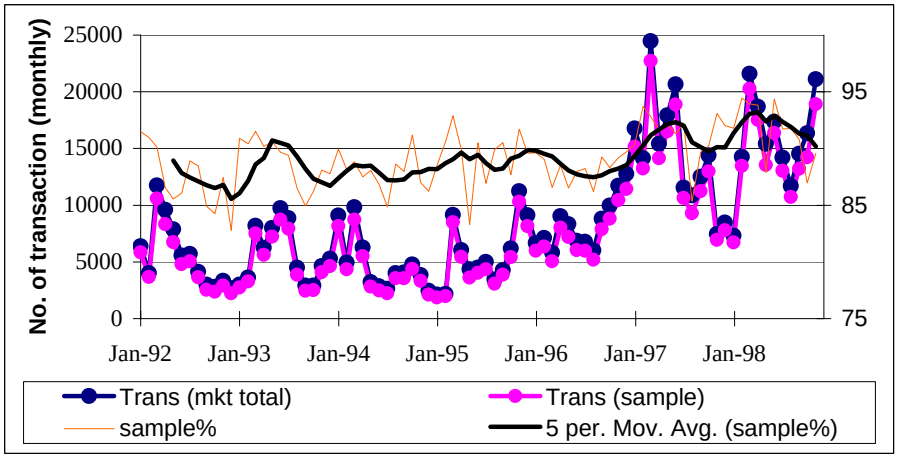


Figure 2b: Movements in Transaction Volume

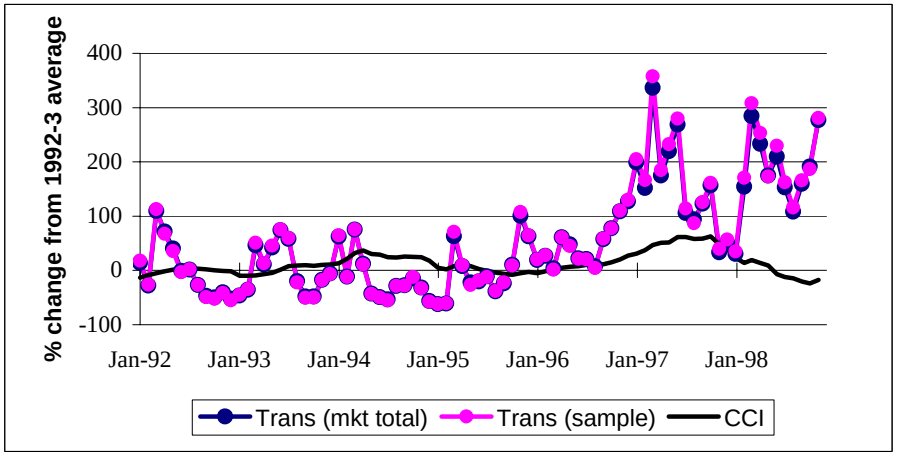
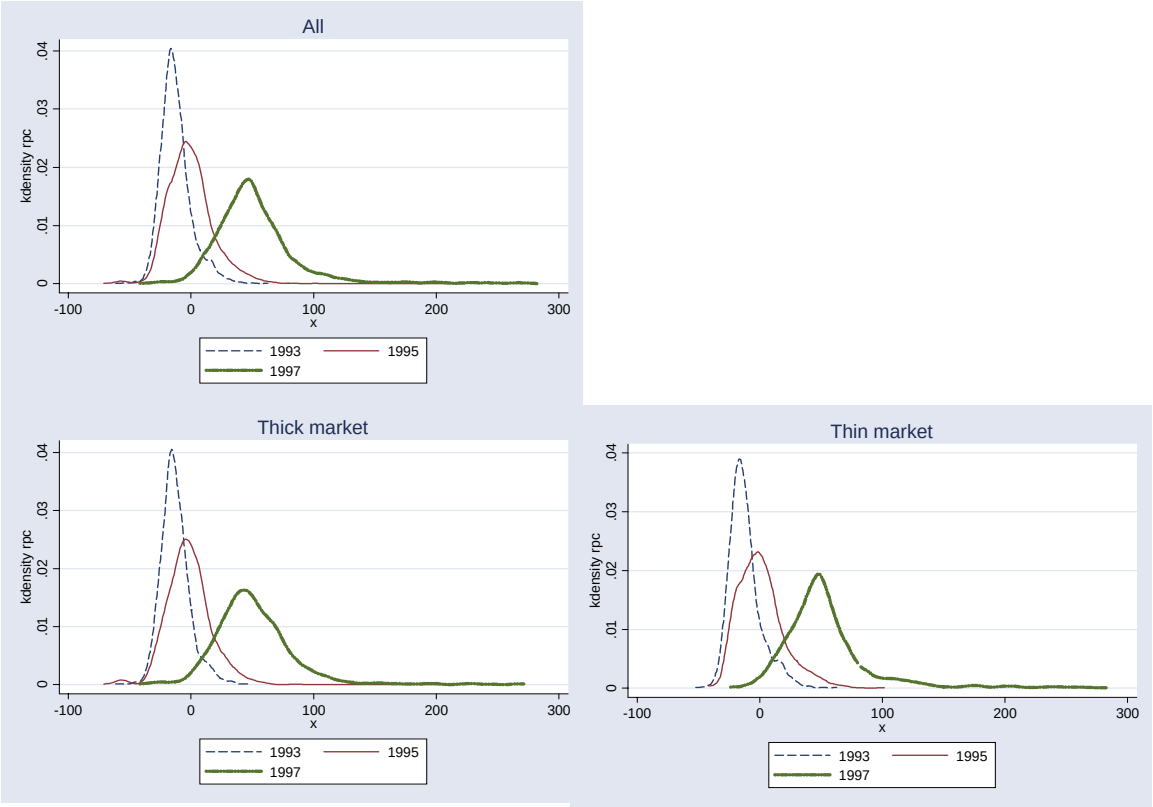
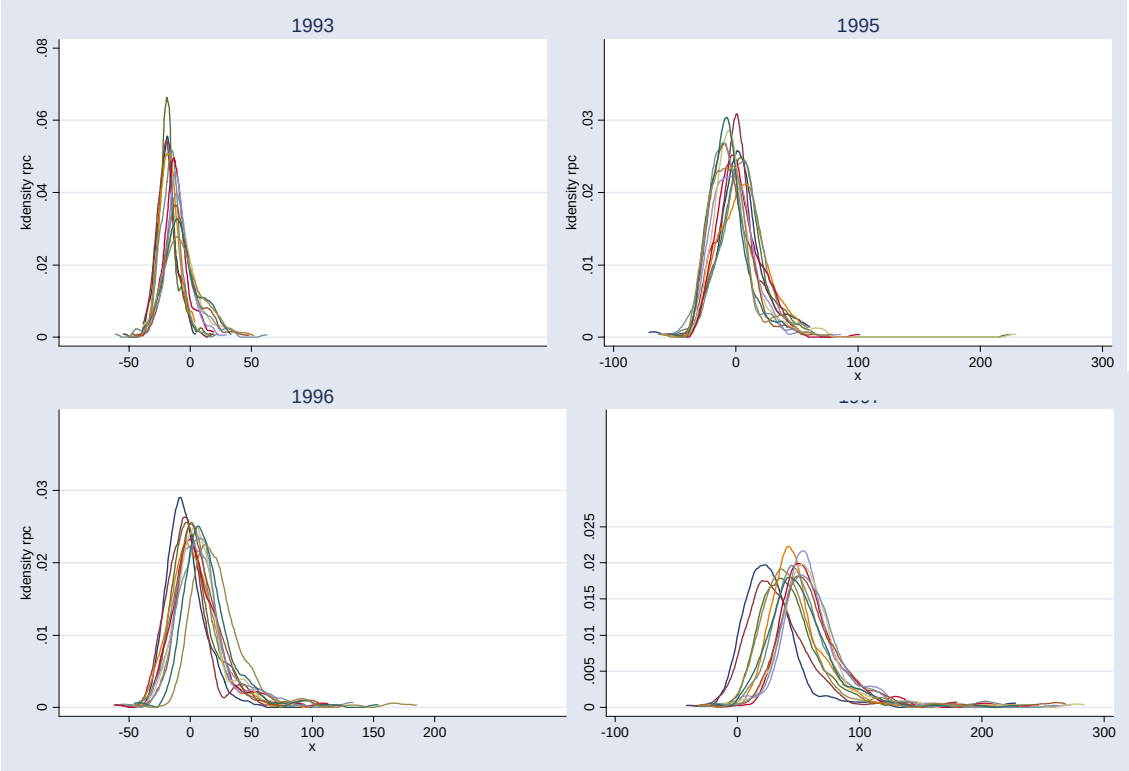


Figure 3a: Cross-sectional variation in price changes by year



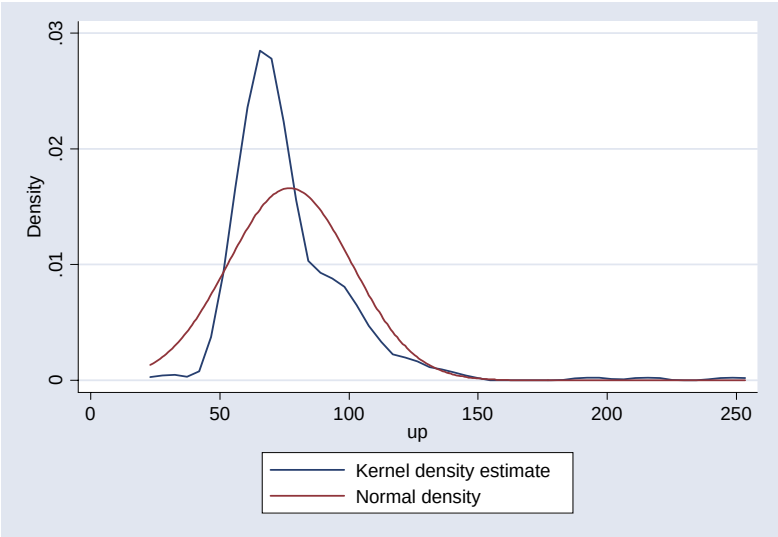
* Kernel density plot of monthly price movements of 266 housing estates by year and month relative to the average price in 1992. Thick market refers to estates with an above-median transaction volume in 1992.

Figure 3b: Cross-sectional variation in price changes by year and month



* Kernel density plot of monthly price movements of 266 housing estatesby year and month relative to the average price in 1992.

Figure 3: Cross-sectional variation in trough-to-peak price changes



* Trough-to-peak price changes are are calculated using quarterly price averages for 266 housing estates over the period 1994-1998. Normal density distribution is included for comparison purposes.

Figure 4: Growth in Housing Stock

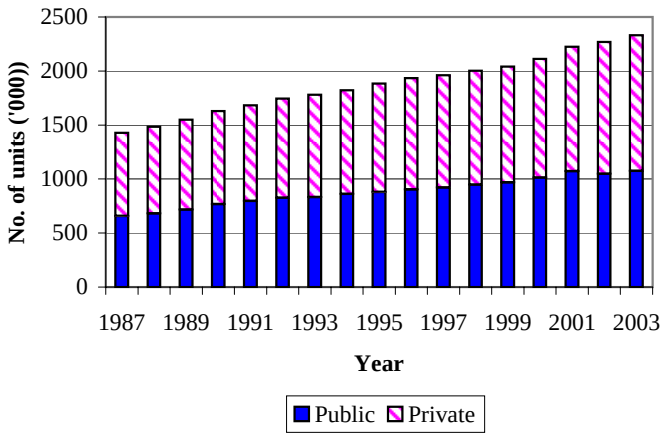


Figure 5: Government Participation in Housing Services Provision

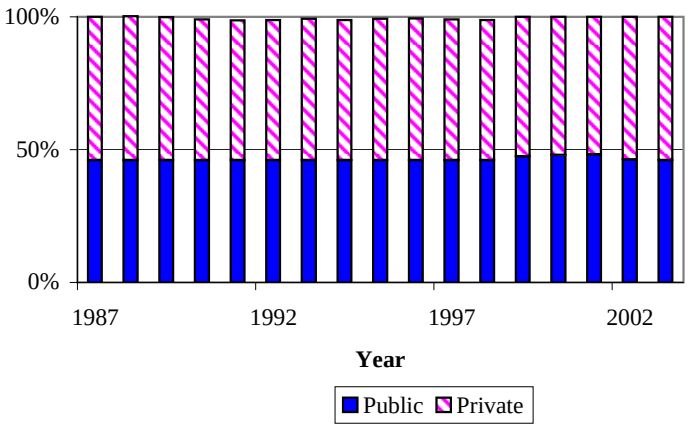


Figure 6: Construction Cost vs. Housing Prices

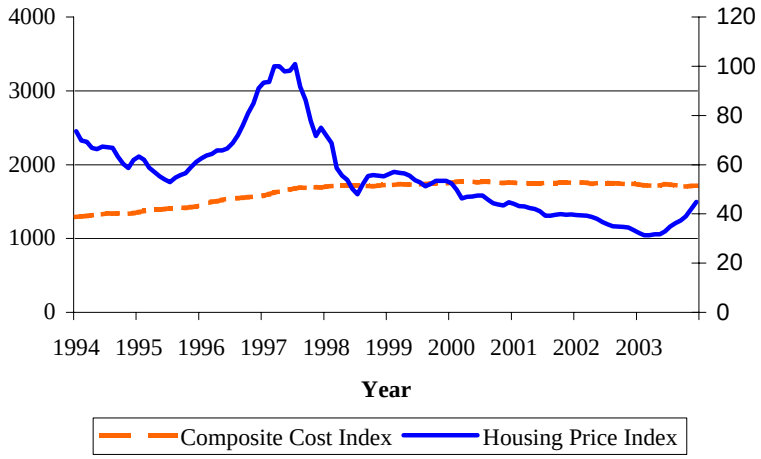


Figure 7: Wage Index vs. Housing Price Index

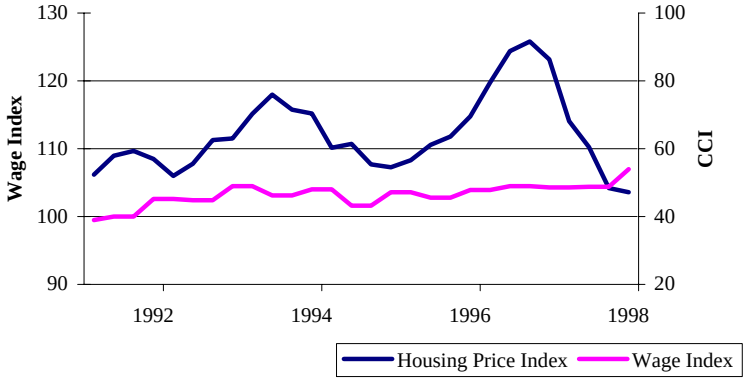


Figure 8: Number of Housing Unit Per Capita

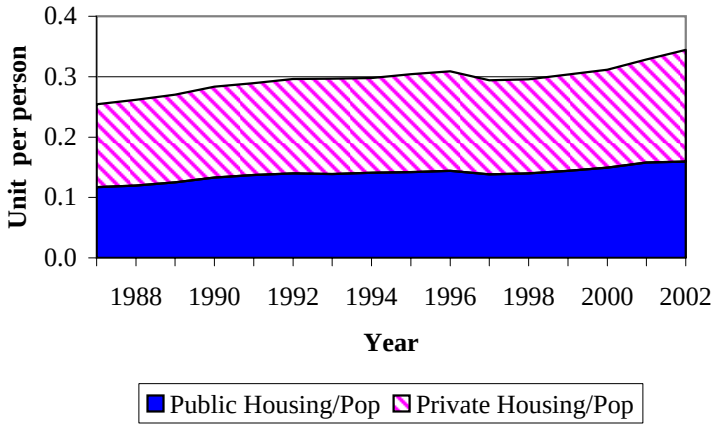


Figure 9: Ownership and Household Formation

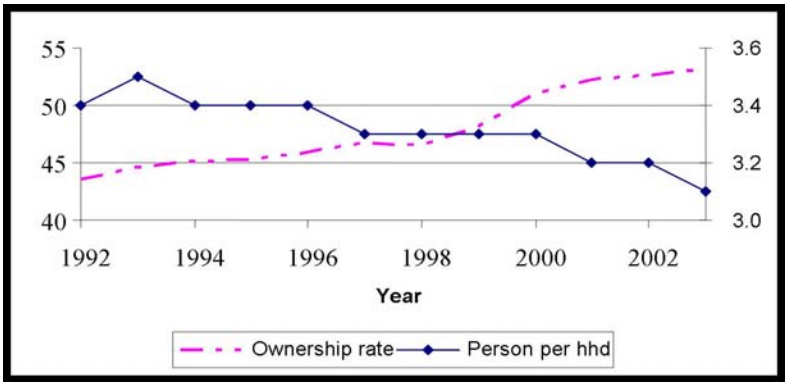


Figure 10: Returns to Housing and Non-Housing Assets

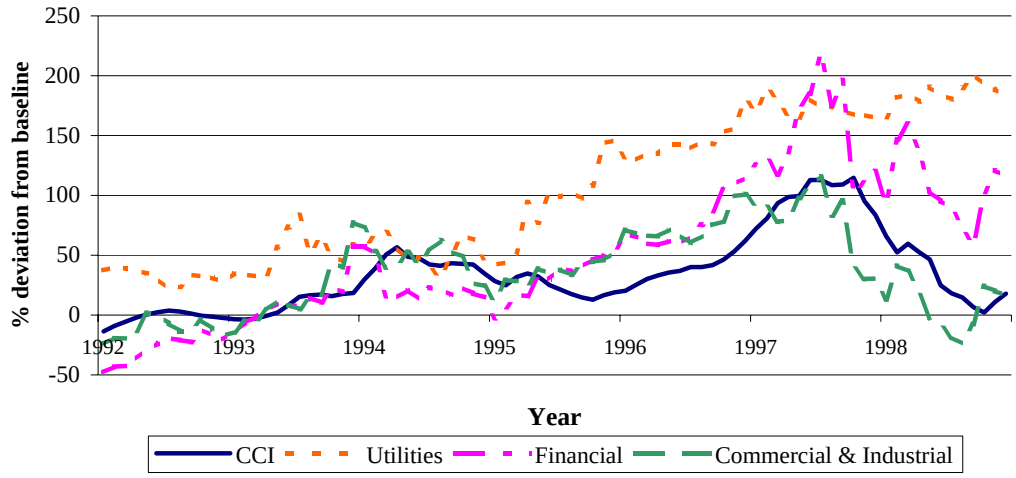


Figure 11: Returns to Asian Stockmarket Indices

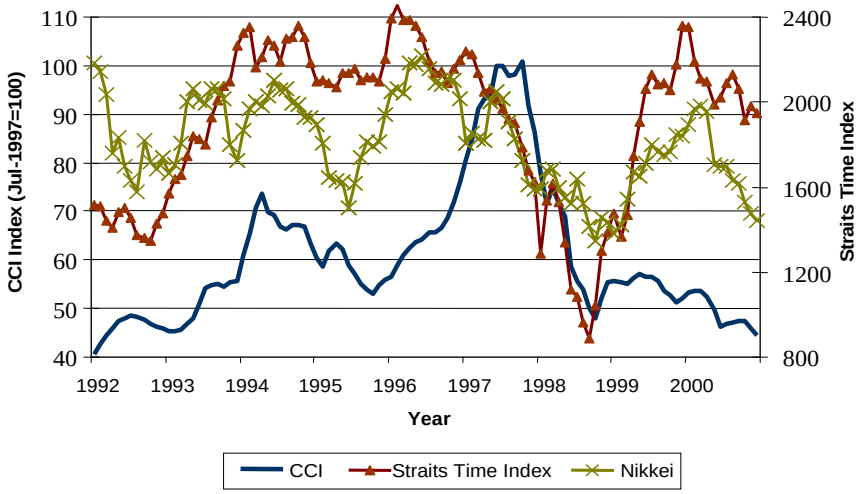


Figure 12: Cost of Capital

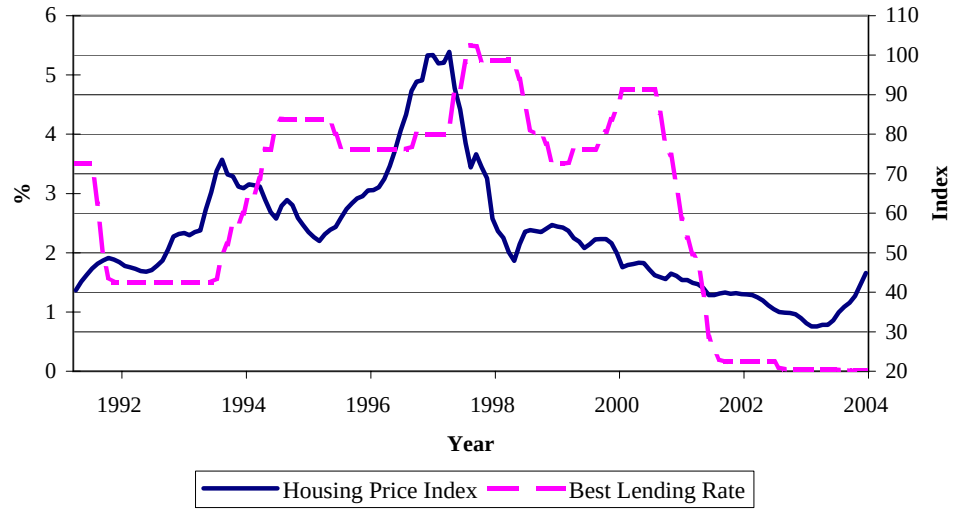


Figure 13: Price-Rent Ratio