Appraisal Bias in Land Premium Valuation

by

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Abstract:

Appraisal bias has been intensively studied from two viewpoints, namely, appraisal smoothing and behavioural appraisal. This paper reviews the literature on appraisal bias and presents an empirical finding on land premium valuation bias. Land premium appraisals are analysed because they can help keep the depreciation factor constant and good pairs of transaction price and estimate. Furthermore, these appraisals are collected from the reported estimates in newspapers, which eliminate the client-agent heuristic. Among the 343 appraisals of land premiums for 109 auctions of land in Hong Kong from 1991 to 1999, evidence of an 8% systematic appraisal downward bias was found in appraisers' estimates against the final bid prices. The result is statistically significant at the 1% level. We put forward three testable hypotheses to explain this phenomenon. They are (1) options-value hypothesis; (2) different-base-of-valuation hypothesis; and (3) heuristic hypothesis. Further empirical studies are required to critically test the three hypotheses.

Keywords: Appraisal Bias, Land Premium, Residual Valuation Method, Heuristic

Introduction

Appraisal bias has been intensively studied since the 1990s. They can be grouped into two main strands, namely (1) appraisal smoothing argument and (2) appraiser-behavior contention. Geltner (1989a, 1989b, 1991, 1993, 1998), Giaccotto and Clapp (1992), Clayton et al. (2001), Fu and Ng (2001), Quan and Quigley (1991), etc. represent the former camp, whereas Diaz (1997), Diaz and Wolverton (1998), Hansz and Diaz (2001), etc. represent the latter one. Table 1 shows a summary of the arguments of these literatures. However, some of the arguments in the former strand focus on technicalities in the process of index construction on aggregated prices, such as Geltner's (1993) temporal aggregation argument. Their models predict a downward biased variance estimate (i.e. appraisal smoothing). Unfortunately, both theoretical and empirical findings did not totally agree with the theories. Lai and Wang (1998) presented a theoretical contention and Webb et al. (1994) produced a conflicting empirical result. Furthermore, many empirical studies compared market transaction prices against appraisers' estimates of housing and home mortgages, yet the differences in the timing of the pair of appraisal and transaction are various. The appraisal bias test may be contaminated by these time differences.

Research in the second strand, however, has been gaining momentum. Since Slovic and Lichtenstein (1971) and Kahneman and Tversky's (1974, 1981, 2000) studies on the heuristics and biases in judgments under uncertainty, the investigation in "framing" has attracted a lot of attention. "Framing refers to well-documented patterns of human reactions to the context, reference points, mental categories, and associations that influence how people make decisions." (Shiller, 2003, p.13) For example, the anchoring behavior of real estate brokers on property pricing decisions has been specifically tested by Northcraft and Neale (1987). They found persistent anchoring to asking price in their estimates. Later on, Diaz (1997) and Diaz and Wolverton (1998) adopted experimental approach and found that appraisers were significantly influenced by their own previous appraisal. More recently, Hansz and Diaz (2001) showed the impacts of transaction price feedback obtained after appraisal

judgment on appraiser's subsequent valuation judgments. Cho and Megbolugbe (1996), on the other hand, put forward their "testing bias" argument based on moral hazard. They contended that the institutional setting of property appraisers puts a heavy burden of proof for low apprised values for mortgages application. They examined 600,000 mortgages purchased by Fannie Mae in 1993 and found that the lower the loan-to-value ratios, the more likely the appraised value was below the pending sale price. Chinloy et al. (1997) further argued that appraisers faced an asymmetric cost function such that a below-pending-sale-price appraisal incurred much higher costs of justification. They concluded that this asymmetric cost function led to a systematic upward appraisal bias. Hansz and Diaz (2001) concluded that appraisers might develop a heuristic of subconscious asymmetrical weights based on seriousness of consequences. Yet, they did not rule out the cause of pervasive conservative bias (i.e. a bias to estimate lower values) in appraisals.

Heuristic behavior leading to systematic bias in property and land valuation is of paramount importance to stakeholders of real estate markets. The problem does not lie on the bias itself, but on the systematic upward or downward bias. Since random bias is ubiquitous and does not greatly affect investors' decisions, yet non-random and systematic bias will affect investors' judgments. Readers may refer to Bretten and Wyatt (2002) for a review of random appraisal bias. They also carried out a questionnaire survey to 220 stakeholders in the UK and found that heuristics was a key reason of appraisal bias. Levy and Schuck (2005) also conducted interviews with property executives in New Zealand and concluded that valuations were greatly influenced by clients.

However, almost all of these heuristics studies are experimental or opinion surveys rather than empirical in nature. The difficulties in conducting direct empirical studies on this behavioural appraisal are understandable because the pair of transaction price and appraisal value is not commonly available at the same time and it is hard to keep other things being equal. Fortunately, land auctions provide a good data set for an empirical analysis. First, the pairs of transaction price and appraisal value are readily available and the transactions are normally engaged just after a few weeks of the appraisals. Second, the factors of depreciation and asset conditions can be ignored in land appraisals. Lastly, the appraisal results are released to the public in news report and they are conducted by various consultants and professionals. In other words, the principle-agent problem and the peculiarity (heuristics and biases) of some appraisers can be removed.

Current Practice of Land Premium Appraisal

According to the Guidance Notes of the Royal Institution of Chartered Surveyors, land value appraisal is commonly carried out by the residual valuation method. Land price is equal to the market price of the property to be developed less the construction cost, interest cost, gross development profit, marketing and transaction costs.

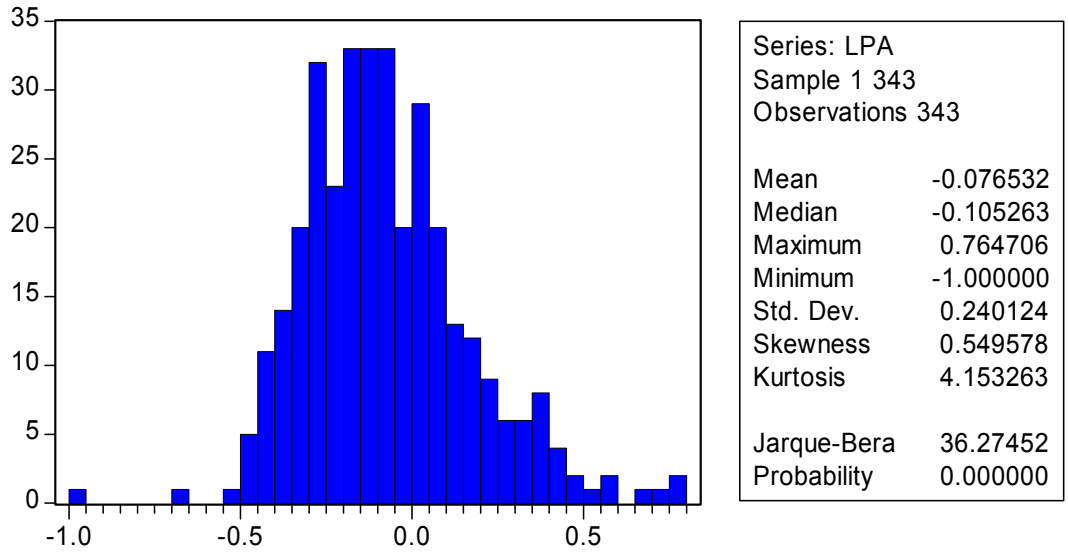
Land auction in Hong Kong has been implemented for more than 150 years. All land sold are leasehold interests and land premium for land use rights during the tenure is bid in the auction. The whole process is very transparent. The highest bidder has to fulfill all the conditions set out in the conditions of sale before granting the leasehold interests. The conditions of sale are publicly available in the government homepage well before the auctions. The mass media keep close monitoring on the process and the results. Different appraisers are often invited to give estimates to be released in news reports before the auctions. In the conditions of sale, all details of the land including the tenure, the use of land, the site area, and the maximum permissible

gross floor area to be developed, etc. are clearly designated. Moreover, the interest rate in Hong Kong has to follow that in the US due to the currency board system, the speed of development in Hong Kong is also very fast, a large-scale residential development can commonly be completed in three years time. Thus, relevant information available is efficiently distributed almost at no cost, a consistent under- or over-estimation of these bid prices by appraisers needs to be explained.

Data and Results

We have therefore collected 343 appraisals of land premium for 109 auctions of land in Hong Kong from 1991 to 1999. The appraisals and the bid prices are collected from the reported estimates and transacted prices in the newspapers, which eliminate the client-agent heuristic. Figure 1 shows the frequency distribution and the summary statistics of the differentials (differences between appraisals and actual bid prices). The differentials ranged from -100% to +76.5%. The frequency distribution was seriously negatively biased.

Figure 1 Frequency Polygon of the Differentials (Differences between Appraisals and Actual Bid Prices)



By means of a simple t-test, Table 1 shows that the appraisals are statistically significantly downward biased by about 8% at the 1% significance level. We also found that there is no significant difference between the estimates of surveyors and that of non-surveyors (e.g. real estate agents). There are 230 and 113 estimates by surveyors and non-surveyors identified in the sample. The averages of their differentials are -7.4% and -8.2% respectively, but the difference is not statistically significant as shown in Table 2.

Table 1 t-test result of the Differentials

Hypothesis Testing for LPA

Sample: 1 343

Included observations: 343

Test of Hypothesis: Mean = 0.000000

Sample Mean = -0.076532

Sample Std. Dev. = 0.240124

Method	Value	Probability
t-statistic	-5.902771	0.0000

Table 2 t-test Result of the Equality of Means of the Differentials between Surveyors and Non-surveyors

Test for Equality of Means of LPA

Categorized by values of SURVEYOR

Sample: 1 343

Method	df	Value	Probability
t-test	341	0.285077	0.7758
Anova F-statistic	(1, 341)	0.081269	0.7758

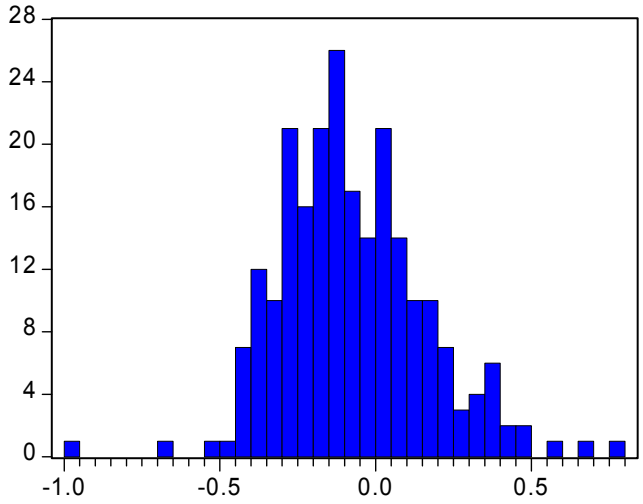
Analysis of Variance

Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	0.004699	0.004699
Within	341	19.71493	0.057815
Total	342	19.71963	0.057660

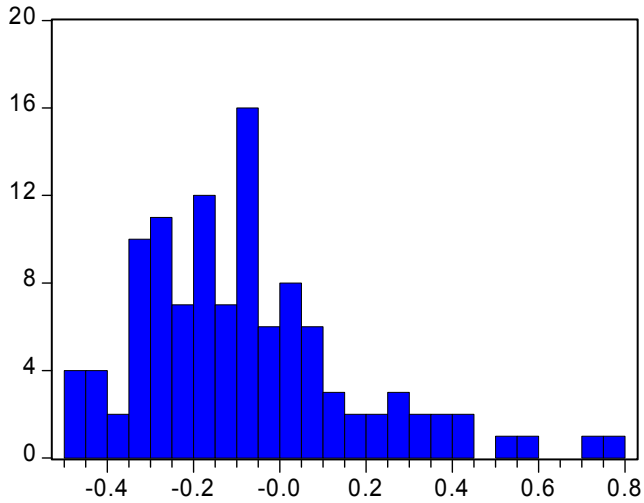
Category Statistics

SURVEYOR	Count	Mean	Std. Dev.	Std. Err. of Mean
0	113	-0.081813	0.250069	0.023525
1	230	-0.073938	0.235599	0.015535
All	343	-0.076532	0.240124	0.012965

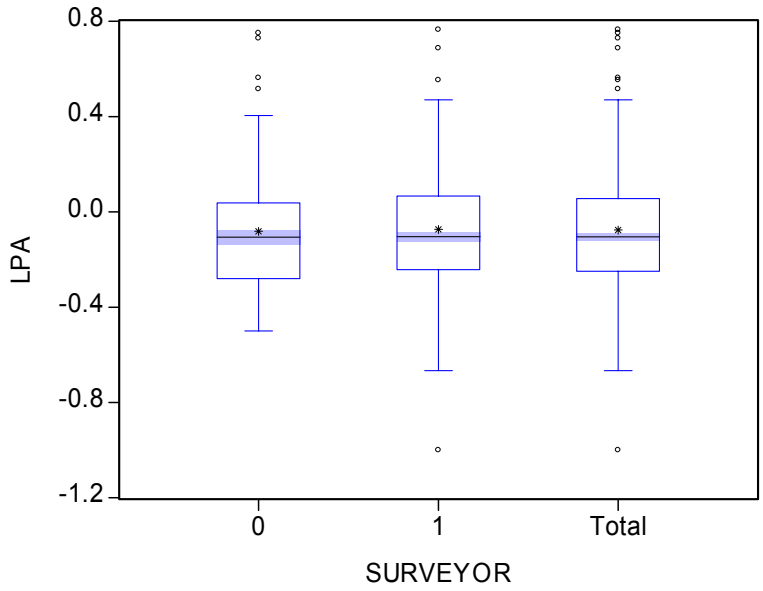
Figures 2a and 2b show the frequency polygons and summary statistics of the two subgroups: Surveyors and Non-Surveyors respectively. Figure 2c depicts the box-plots by classification of the subgroups. They reflect that surveyors' estimates deviate more from the actual bid price, but skew less to the right. The averages of the differentials of the two subgroups are still significantly negative (t-test results not shown)



Series: LPA	
Sample 1 343 IF SURVEYOR = 1	
Observations 230	
Mean	-0.073938
Median	-0.104668
Maximum	0.764706
Minimum	-1.000000
Std. Dev.	0.235599
Skewness	0.329412
Kurtosis	4.221081
Jarque-Bera	18.44877
Probability	0.000099



Series: LPA	
Sample 1 343 IF SURVEYOR = 0	
Observations 113	
Mean	-0.081813
Median	-0.106250
Maximum	0.750000
Minimum	-0.500000
Std. Dev.	0.250069
Skewness	0.932640
Kurtosis	4.067703
Jarque-Bera	21.74900
Probability	0.000019



Three Possible Explanations

The consistent under-estimations in land premium in Hong Kong have at least three plausible and testable explanations. The three possible reasons are the (1) options-value hypothesis; (2) different-base-of-valuation hypothesis; and (3) heuristic hypothesis;. They require further empirical tests to identify which one(s) is/are the real reason(s). They are discussed as follows:

Options-value Hypothesis

The real options value in land development has been well developed and there have been numerous studies in land development options. At least four empirical studies in land development options are available, they are Quigg (1993), Sing (2001) Yamazaki (2001) and Chiang et al. (2005) in the land markets of Seattle, London, Tokyo and Hong Kong respectively.

Quigg (1993) found a mean option premium of 6% of the theoretical land value by identifying the option model price and the intrinsic value of 2,700 land transactions in Seattle. She also tested empirically on the data by regressing the market price of land parcel with, among others, the intrinsic value and the option premium (the difference between the option model value and the intrinsic value). Her results showed that the coefficients for the option premium were uniformly positive and statistically significant.

Sing (2001) followed Quigg's specifications and empirically estimated the values of options based on the commercial property transaction data in the UK. However, Sing (2001) simplified Quigg's model to a one stochastic variable on rental income by assuming deterministic development cost. He has also assumed zero income of undeveloped land. He also found a positive and significant option premium.

Yamazaki (2001), on the other hand, tested the option value of land in Central Tokyo, without using any option pricing models. He regressed the log of land price index with, among others, the total uncertainty with respect to built asset return and the systematic risk associated with owning developed real estate assets. His results showed that the total uncertainty with respect to built asset return had a substantial effect on increasing the price of land.

Chiang, et al (2005) modified the model of Quigg (1993) to formulate their option model. Based on records of land auction and property transactions in Hong

Kong, land prices were derived from both their modified model and traditional hedonic pricing model. A comparison between land prices derived from the two models suggested that land auction prices had imbedded option value. As expected, option premiums increased with implied volatilities that went up during market recessions, when developers placed higher value on the option value.

Unfortunately, real options price is not commonly estimated in land value appraisal. As Patel et al (2005) suggested, there are ten major challenges in using and valuing real property options, including the availability of data, difficulties in the estimation of volatilities and complexities in leasing and operation conditions. The consistent under-estimations in land premium may reflect the options value possessed by the bidders. Appraisers who estimate land premium based on traditional valuation methods or hedonic pricing model may not have taken into their consideration the options value, which developers have somehow allowed for in their bids.

Different-base-of-valuation Hypothesis

Another possible hypothesis to explain the systematic undervaluation of land auction bids in Hong Kong lies in the different decision models adopted by appraiser vis-à-vis developer. We postulate that appraisers and developers follow different models in deriving their respective estimates of land value. The differences lie in how they process the data, what data they include and neglect in the valuation exercises. The reason for such variations can be explained by their different roles and interests in the process of land development. We postulate that developers are inclined to adopt a 'Three-Dimensional' approach in coming up with a value (or range) of land premium they find acceptable for the site. This approach does not only consider technical and institutional development constraints of the site in greater detail, but it also contains certain degree of deliberation about possible physical design of the project should it go ahead on the site. Appraisers, on the contrary, do not use this approach but rather rely on aggregate numeric data and their interpretation of market comparables in determining land value estimates.

A simple evidence to elucidate this difference is concerned with the total floor area to be developed on the site. Government lease stipulates the maximum permissible amount of 'gross floor area' (GFA) on every auction site. This is an important figure that determines development intensity of the site and constitutes the key basis for land value assessment by developers. However, it is wrong to conceive that the maximum level of GFA is indeed the highest possible amount of 'saleable' floor space of the development to be offered to market buyers. Current government building regulations allow a certain amount of floor space to be exempted from counting towards maximum GFA restriction under the lease. To what extent a developer could realize such floor space exemption depends on building design for the project. There is, therefore, an incentive for developers to think about physical project design at the pre-auction stage in ascertaining how much extra floor space they could ultimately get from the site and sell.

Appraisers, however, do not take such an approach. Conventional education and training, as we are familiar with, encourages appraisers to put emphasis on numerical data rather than architectural design. Thus, they tend to have less incentive as well as ability in thinking about possible 'design schemes' or 'design scenarios' of development on auction sites. Aggregate data will be used in assessing appropriate land values of the sites. The maximum restriction of GFA under the lease is a common reference point in land valuation. Adjustments to gross development value and estimate of land bid are then made with reference to comparables in property prices,

building costs, funding costs and expected developers profits as Hager and Lord (1985) stated:

> 'The success of the valuation relies extensively on personal knowledge and expertise and interpretation of the many variables which exist. A valuation therefore remains an expression of personal opinion.'

In fact, it is an open secret in the industry that the amount of 'saleable' floor space after project completion exceeds maximum permissible GFA under the lease. Based upon a sample of 23 auction sites sold by the government between 1991 and 1995, Hui (2000) has found that 'saleable' floor areas of such development exceeded lease restrictions by 10.1% on average. The intriguing questions therefore are: Why have Hong Kong appraisers not taken this simple fact into account? Why have they not raised their conventional estimates by 8-10% and eliminated the systematic underestimate?

It is suggested that the primary role of an appraisers is to project the "market value" of the land sale. The principal assumption adopted by appraisers is to derive the market value such that there is no special interests among willing buyers and sellers. In other words, virtually all the variables under the appraisers' valuation models are exogenous (i.e. market determined). They rely very much on recent market transactions (comparables) to estimate. More importantly, the values of the variables adopted in the models should not reflect any special interests associated with any special buyers. It does not suggest that appraisers are not aware of the existence of these special buyers. It is their professional trainings that refrains the appraisers from considering these special interests when they assess the fair "market value".

Particular developers, on the contrary, can achieve a higher value of property price if they optimize option-value and saleable areas. They can also acquire lower costs of construction, cost of interest, gross development profit and marketing and transaction costs if they possess cost advantages. For instance, developers who possess economies of scales, expertise, or stronger bargaining powers in soliciting cheaper sources of resources and funds can bid for a higher land price than the counterparts. Admittedly, it does not necessarily suggest that large-sized developers will always outbid the small-to-medium sized ones because the former may not have comparative advantages over the latter for all projects. Developers can make reference to their own completed projects so as to assess their real costs of development, finance and marketing. These are considered their "insider knowledge" and appraisers are hard to know.

Heuristic Hypothesis

The reason may lie with the institutions. All parties find it desirable to underestimate land values against final bids and implicitly let 'unexpectedly good' auction results to create a sense of exuberance in economic prospects of Hong Kong. Sociologists such as John Logan, Harvey Molotch and Alan Harding, have suggested the existence of a coalition comprising property owners, developers, bankers, professional and local media which have an interest in rising property prices. Such coalition, called a growth machine, is backed by corporate capital and government, which are supportive to local economic growth (Logan & Molotch, 1987; Molotch, 1993; Harding, 1994). Property market has a disproportionate weight in Hong Kong economy which is described by Haila (2000) as a 'property state'. Government land auction is relied upon as a barometer of confidence in its local economy because

government officials, local media and professional have all wished the public to see it that way:

> "Commenting on the land sale results, the Secretary for Planning, Environment and Lands, Tony Eason, said that he was heartened by the enthusiastic bidding seen for both the Cox's Road and Stanley residential sites which sold at higher than the opening prices. It is a very positive signal from the market that there is strong demand for prime residential sites." [Eason said.]' (*South China Morning Post,* 23 August 1995)

> "Paul Tam Ming-tak, chief estate agent at the Lands Department, said yesterday the bidding showed developers' confidence in the market despite the anticipated increase in land supply in coming years." (*South China Morning Post*, 28 August 1997)

> "The high prices paid at this week's land auction are a reflection of the growing confidence that, whatever the present political and economic uncertainties, the fundamentals underlying Hong Kong's success will remain strong long beyond next year's transfer of sovereignty." (*South China Morning Post*, 16 August 1996)

> "Michael Clarke, director of Colliers Jardine's professional services division, said the land sales indicated developers' increasing confidence in the property market. The keen competition for the Tsuen Wan site also indicated developers were optimistic about the potential for the mass housing market, he said." (*South China Morning Post*, 28 November 1995)

This institutional background may explain why Hong Kong appraisers have consistently underestimated developers' final bids, and more importantly, why they have not corrected their past 'systematic mistakes'. The maximum GFA figure stipulated under the lease gives a lower denominator and can generate a "higher-than-expected"' accommodation value when the hammer is down. As a result, the property market gets ignited with expectation of more business and market opportunity. There is little incentive for anyone in the market to correct such bias. Indeed, when the appraisal bias (8% under) and development floor space bias (10% over) are considered together, it turns out that perhaps actual differences between appraisers and developers about market price per unit floor area are deceptive rather than real. In other words, it is wrong to say that developers are more risk-taking or market-smarter than appraisers in terms of their accommodation value assessment.

Conclusions

Appraisal bias has been intensively studied though, they have three shortcomings. First, they are reflected in aggregate price indices where the bias may be the results of the aggregation process. Second, they are not empirically supported but experimentally identified. Third, the pairs of transaction price and estimates are not in fixed interval which does not keep other things being equal. We, however, devised a method on the disaggregate price of land for an empirical test of appraisal bias. We found 8% consistent and significant undervaluation of land premium in the public land auctions of Hong Kong. This empirical study is probably the first non-aggregate price analysis on land which shows an appraisal downward bias, *ceteris paribus*. They

are explained by (1) options value hypothesis; (2) different-base-of-valuation hypothesis; and (3) heuristics hypothesis. Casual observations based on the second explanation also support the 8% magnitude, yet a more robust test is necessary to identify the real reason(s) of the under-estimation. This paper coalesces three different perspectives of real estate pricing which can imply the same undervaluation phenomenon. More efforts are required to test critically on the three hypotheses.

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References

Berkeley, D. and Humphreys, P. (1982) Structuring Decision Problems and the 'Bias Heuristic', *Acta Psychologica*, 50, 201-252.

Block, R.A. and Harper, D.R. (1991) Overconfidence in Estimation: Testing the Anchoring-and-Adjustment Hypothesis, *Organizational Behavior and Human Decision Processes*, 1991, 49, 188-207.

Bretten, J. and Wyatt, P. (2002). Variance in property valuations for commercial lending, *RICS Research Papers*, 4(9), UK: Royal Institutions of Chartered Surveyors.

Breuggeman, W., Chan, A. and Thibodeau, T. (1992). Some Additional Evidence on the Performance of Commingled Real Estate Investment Funds: 1972-1991, *Journal of Real Estate Research*, 7, 433-448.

Brown, G.R. (1991). *Property Investment and the Capital Markets*, E & FN Spon, London.

Byrne, P. and Lee, S. (1995). Is there a place for property in the multi-asset portfolio, *Journal of Property Finance*, 6(3), 60-83.

Chiang, Y.H., So, Joinkey C.K. and Yeung, Stanley C.W. (2006) Real option premium in Hong Kong Land prices, *Journal of Property Investment and Finance*, accepted for publication.

Cho, M. and Megbolugbe, I. (1996). An empirical analysis of property appraisal and mortgage redlining, *Journal of Real Estate Finance and Economics*, 13(1), 45-55.

Clayton, J., Geltner, D. and Hamilton, S.W. (2001). Smoothing in Commercial Property Valuations: Evidence from Individual Appraisals, *Real Estate Economics*, 29(3), 337-360.

Cole, R. (1988). *A New Look at Commercial Real Estate Returns*, Ph.D. Dissertation, University of North Carolina-Chapel Hill, University Microfilms International: Ann Arbor, MI.

Corgel, J.B. and deRoss, J.A. (1999). Recovery of Real Estate Returns for Portfolio Allocation, *Journal of Real Estate Finance and Economics*, 18(3), 279-296.

Dewit, D.P.M. (1993). Smoothing Bias in In-House Appraisal-Based Returns of Open-End Real Estate Funds, *Journal of Real Estate Research*, 8, 157-170.

Diaz, J. (1997). An Investigation into the Impact of Previous Expert Value Estimates on Appraisal Judgment, *Journal of Real Estate Research*, 13(1), 57-66.

Diaz, J. and Hansz, J.A. (1997). How Valuers Use the Value Opinions of Others,

Journal of Property Valuation and Investment, 15(3), 256-260.
Diaz, J. and Hansz, J.A. (2001). The Use of Reference Points in Valuation Judgment, *Journal of Property Research*, 18(2), 1-8.
Diaz, J. and Wolverton, M.L. (1998). A Longitudinal Examination of the Appraisal Smoothing Hypothesis, *Real Estate Economics*, Summer, 26(2), 349-358.
Firstenberg, P.M., Ross, S.A. and Zisler, R.C. (1988). Real Estate: The Whole Story, *Journal of Portfolio Management*, Spring, 22-32.
Fisher, J.D. and Geltner, D. (2000). Delagging the NCREIF Index: Transaction Prices and Reverse-Engineering, *Real Estate Finance*, 17(1), 7-22.
Fisher, J.D., Geltner, D. and Webb, R.B. (1994). Value Indices of Commercial Real Estate: A Comparison of Index Construction Methods, *Journal of Real Estate Finance and Economics*, 9, 137-164.
Fisher, J.D., Miles, M. and Webb, R.B. (1999). How Reliable are Commercial Property Appraisals? Another Look, *Real Estate Finance*, 16(3), 9-15.
Fu, Y. (2002). A Structural Approach to Estimating the Lagging Error in Real Estate Price Indices, Presented in the *8th AsRES Conference*, 21 July 2003, National University of Singapore, Singapore.
Fu, Y. and Ng, L.K. (2001). Market Efficiency and Return Statistics: Evidence from Real Estate and Stock Markets Using a Present-Value Approach, *Real Estate Economics*, 29(2), 37-61.
Gallimore, P. (1994). Aspects of Information Processing in Valuation Judgment and Choice, *Journal of Property Research*, 11(2), 97-110.
Gallimore, P. (1996). Confirmation Bias in the Valuation Process: A Test for Corroborating Evidence, *Journal of Property Research*, 13(4), 261-273.
Geltner, D. (1989a). Estimating Real Estate's Systematic Risk from Aggregate Level Appraisal-Based Returns, *Journal of the American Real Estate and Urban Economics Association (AREUEA Journal)*, 17, 463-481.
Geltner, D. (1989b). Bias in Appraisal-Based Returns, *Journal of the American Real Estate and Urban Economics Association (AREUEA Journal)*, 17(3), 338-352.
Geltner, D. (1991). Smoothing in a Appraisal-Based Returns, *Journal of Real Estate Economics and Finance*, 4, 327-345.
Geltner, D. (1993). Temporary Aggregation in Real Estate Return Indices, *Journal of the American Real Estate and Urban Economics Association (AREUEA Journal)*, 21, 141-166.
Geltner, D. (1998). Appraisal smoothing: the other side of the story – a comment, Financial Economics Network .www.ssrn.com, *Working paper*, Department of Finance, University of Cincinnati.
Geltner, D. and Goetzman, W. (2000). Two Decades of Commercial Property Returns: A Repeated-Measures Regression-Based Version of the NCREIF Index, *Journal of Real Estate Finance and Economics*, 21(1), 5-21.
Geltner, D. and Miller, N. (2001). *Commercial Real Estate Analysis and Investments*, South-Western College Publishing Company, Cincinnati.
Giaccotto, C. and Clapp, J. (1992). Appraisal-Based Real Estate Returns under Alternative Market Regimes, *Journal of the American Real Estate and Urban Economics Association (AREUEA Journal)*, 20, 1-24.
Giliberto, M. (1988). A Note on the Use of Appraisal Data in Indexes of Performance Measurement, *Real Estate Economics*, 16(1), 77-83.
Graff, R. and Young, M. (1996). Real Estate Return Correlations: Real-World Limitations on Relationships Inferred from NCREIF Data, *Journal of Real Estate Finance and Economics*, 13(2), 121-142.

Hager, D. and Lord, D. (1985). *The property market, property valuations and property performance measurement*, London: Institute of Actuaries.
Haila, A. (2000). Real estate in global cities: Singapore and Hong Kong as property states. *Urban Studies, 37*(12), 2241-2256.
Hamilton, S.W. and Clayton, J. (1999). Smoothing in Commercial Property Valuations: Evidence from the Trenches, *Real Estate Finance*, Fall, 16(3), 16-26.
Hansz, J.A. and Diaz, J. (2001). Valuation bias in commercial appraisal: a transaction price feedback experiment, *Real Estate Economics*, 29(4), 553-565.
Harding, A. (1994). Urban regimes and growth machines: toward a cross-national research agenda. *Urban Affairs Quarterly, 29*(3), 356-382.
Hendershott, P.H. and Kane, E.D. (1995). U.S. Office Market Values During the Past Decade: How Distorted Have Appraisals Been?, *Real Estate Economics*, 23, 101-116.
Hogarth, R. (1981). Beyond Discrete Biases: Functional and Dysfunctional Aspects of Judgment Heuristics, *Psychological Bulletin*, 90, 197-217.
Hui, H. K. (2000). *Valuation of auctioned land,* Unpublished BSc. Dissertation. The Hong Kong Polytechnic University.
Ibbotson, R. and Siegel, L. (1984). Real Estate Returns: A Comparison with Other Investments, *Journal of the American Real Estate and Urban Economics Association (AREUEA Journal),* 12(3), 219-242.
Johnson, E.J. and Schkade, D.A. (1989). Bias in Utility Assessments: Further Evidence and Explanations, *Management Science*, 35, 406-424.
Kahneman, D. and Tversky, A. (1974). Judgment under uncertainty: Heuristics and Biases, *Science*, 185 (4157).
Kahneman, D. and Tversky, A. (1981). The Framing of Decision and the Psychology of Choice, *Science*, 211 (4481), Jan. 30.
Kahneman, D. and Tversky, A. (2000). *Choices, Values and Frames*, Cambridge: Cambridge University Press and Russell Sage Foundation.
Lai, T.Y. and Wang, K. (1998). Appraisal Smoothing: the Other Side of the Story, *Real Estate Economics*, Fall, 26(3), 511-535.
Lawrence, M. and O'Connor, M. (1992). Exploring Judgmental Forecasting, *International Journal of Forecasting*, 8, 15-26.
Levy, D. and Schuck, E. (2005). The influence of clients on valuations: the clients' perspective, *Journal of Property Investment and Finance*, 23(2), 182-201.
Logan, J. R., & Molotch, H. L. (1987). *Urban fortunes: the political economy of place*. Berkeley, Calif.: University of California Press.
Miles, M. Cole, R. and Guilkey, D. (1990). A different look at commercial real estate returns, *Journal of the American Real Estate and Urban Economics Association (AREUEA Journal)*, 18(4), 403-430.
Molotch, H. (1993). The political economy of growth machines. *Journal of Urban Affairs, 15*(1), 29-53.
North, D.C. (2005). *Understanding the process of economic change,* Princeton: Princeton University Press.
Northcraft, G.B. and Neale, M.A. (1987). Experts, Amateurs and Real Estate: An Anchoring-and-Adjustment Perspective on Property Pricing Decisions, *Organisational Behavior and Human Decision Processes*, 39, 84-97.
Patel, K., Paxson, D. and Sing, T.S. (2005) A review of the practical uses of real property options, *RICS Research Paper Series*, 5:1 (April).
Quan, D.C. and Quigley, J.M. (1989). Inferring an Investment Return Series for Real Estate from Observations on Sales, *Journal of the American Real Estate and*

Urban Economics Association (AREUEA Journal), 17, 218-230.
Quan, D.C. and Quigley, J.M. (1991). Price Formation and the Appraisal Function in Real Estate Markets, *Journal of Real Estate Finance and Economics*, 4, 127-146.
Quigg, L. (1993). Empirical testing of real option-pricing models, *Journal of Finance*, 48(2), 621-640
Ross, S.A. and Zisler, R.C. (1991). Risk and Return in Real Estate, *Journal of Real Estate Finance and Economics*, 4, 175-190.
Shiller, R.J. (2003). *The New Financial Order: Risk in the 21st Century*, Princeton: Princeton University Press.
Sing, T.F. (2001), Optimal timing of a real estate development under uncertainty, *Journal of Property Investment and Finance*, 19(1), 35-52
Slovic, P. and Lichtenstein, S. (1971). Comparison of Bayesian and Regression Approaches to the Study of Information Processing in Judgement, *Organizational Behavior and Human Performance*, 6, 649-744.
South China Morning Post, Auction hopes dashed. February 23, 1995.
South China Morning Post, Battle for peak site stirs new confidence. August 28, 1995.
South China Morning Post, Top site sells for $5.55b. August 28, 1997.
South China Morning Post, Vote of confidence. August 16, 1996.
Sterman, J.D. (1989). Misperceptions of Feedback in Dynamic Decision Making, *Organizational Behavior and Human Decision Processes*, 43, 301-335.
Switzer, F.S. and Sniezek, J.A. (1991). Judgment Processes in Motivation: Anchoring and Adjustment Effects on Judgment and Behavior, *Organizational Behavior and Human Decision Processes*, 49, 208-229.
Tversky, A. and Kahneman, D. (1974). Judgment Under Uncertainty: Heuristics and Biases, *Science*, 185, 1124-1131.
Webb, R.B. (1994). On the Relability of Commercial Appraisals: An Analysis of Properties Sold from the Russell-NCREIF Index (1978-1992), *Real Estate Finance*, 11, Spring, 62-65.
Webb, R.B., Miles, M. and Guilkey, D. (1992). Transactions-Driven Commercial Real Estate Returns: The Panacea to Asset Allocation Models?, *Journal of the American Real Estate and Urban Economics Association (AREUEA Journal)*, 20, 325-357.
Wheaton, W.C. and Torto, R.G. (1989). Income and Appraised Values: A Reexamination of the FRC Returns Index, *Journal of the American Real Estate and Urban Economics Association (AREUEA Journal)*, 17, 539-549.
Wright, W.F. and Anderson, U. (1989). Effects of Situation Familiarity and Financial Incentives on Use of the Anchoring and Adjustment Heuristic for Probability Assessment, *Organizational Behavior and Human Decision Processes*, 44, 68-82.
Yamazaki, R. (2001). Empirical testing of real option pricing models using land price index in Japan, *Journal of Property Investment and Finance*, 19(1), 53-72

Literature Review on Appraisal Bias (in alphabetic order of the author's name)

Authors (year)	**Data descriptions** **(Aggregate – A / Disaggregate – D)**	**Results**	**Methodology** **Empirical (EM) / Experimental (EX) / Theoretical (TH) study on transactions (T) / appraisals (A)**
Bretten and Wyatt (2002)	Questionnaire survey to 220 stakeholders in the UK (D)	60% of valuers agreed that they would increase their valuation figure if external parties exerted pressure to do so.	EX
Chinloy et al. (1997)	600,000 mortgages purchased by Fannie Mae in 1993 (D)	Tested empirically on the hypothesis that residential appraisers face an asymmetric cost function with higher costs for appraised values below pending sale prices as compared to appraised values equal to or above pending sale prices. They found 95% of the appraised values were greater than or equal to the pending sale price. However, the data sample suffers from selection bias because pending sales with low appraisals are often voided.	EM A
Cho and Megbolugbe (1996)	600,000 mortgages purchased by Fannie Mae in 1993 (A)	Compared appraisal-based against transaction-based housing indices and found no evidence of decreased volatility in the appraisal-based indices, but they did find evidence of temporal lag. However, they did not address the question of temporal aggregation at the index construction level.	EM T+A
Clayton et al. (2001)	Individual appraisal reports in 2 Canadian real estate managers, 1986-1996 (D)	They found temporal lag bias in appraisals and appraisers put about 20% of weight on their previous valuation in reappraisal	EM A (appraisal reports)
Cole (1988)	(A)	Demonstrated the reduction in the variability of appraisal-based series by comparing to transaction-based indices	EM A+T
Diaz (1997)	Experiment on appraisers	Did not find support for the contention that either apprentice or expert appraisers faced with a real estate valuation task are influenced by the previous value judgments of anonymous experts.	EX

Diaz and Wolverton (1998)	Experiment on appraisers (D)	They found evidence that appraisers are significantly influenced by their own previous appraisal	EX
Fisher et al (1999)	2,739 transactions of properties sold in the NPI from 1978 to 1998 (D)	Compared sale prices to appraised values of the same properties. When the market was rising, transaction prices were 4.6% and 3.8% higher than appraisals. During the declining market, transaction prices were 4.5% below the appraisals.	EM A+T
Fu (2002)	NCREIF Property Index (A)	Present a state-space model for de-lagging real estate price indices	TH Delagging model
Gallimore (1996)	Questionnaire survey on 416 surveyors in the UK (D)	Found a tendency among appraisers in the UK toward premature judgment	EX
Geltner (1989a)	FRC and PRISA indices (FRC index is compiled by the Frank Russell Company for the National Council of RE Investment Fiduciaries, NCREIF; PRISA index is published by the Prudential Realty Investment Separate Account) (A)	Defined precisely the definition of appraisal smoothing as the ratio of the standard deviation of true portfolio property values to the standard deviation of appraised portfolio property values. Quantified amount of smoothing on the basis of systematic risk	EM+TH A
Geltner (1989b)	--	Offered lack of confidence and valuation timing as two possible explanations of the phenomenon of appraisal smoothing	TH
Geltner (1991)	--	Demonstrated that the variance of appraisal-based returns is reduced if appraisers estimate current appraisal value by averaging the current and past true returns (not current and past appraisal values)	TH
Geltner (1993)	--	Argued that the difference in the timing of appraisals and the interval of the index will also cause an under-estimation of its variance	TH
Geltner (1998)	--	Responded Lai and Wang's argument that they have confused smoothing at the aggregate (index) level with volatility reduction alone at the disaggregate (individual property) level.	TH

Geltner and Goetzmann (2000)	NCREIF Property Index (A)	Used a repeated-measure-regression (RMR) method to re-estimate the NCREIF Property Index using only genuine appraisal reports.	TH De-lagging model
Giaccotto and Clapp (1992)	Monte Carlo Simulation (A)	Exponential smoothing and Kalman filter rules perform well	EM
Hansz and Diaz (2001)	Study experimentally the effect of market feedback on appraisal prices (D)	They found that subjects receiving transaction price feedback indicating that they had been low in previous valuations seem to adjust upwards their subsequent, unrelated value judgments. While the results for subjects receiving the too high feedback were in the expected direction, but not statistically significant.	EX
Hamilton (1997)	250 properties sold, Russell Canadian Index 1985-1995 (D)	Similar results to Webb (1994)	EM T+A
Hamilton and Clayton (1999)	Quantify appraisal smoothing at the individual property level, 347 individual appraisal reports in 2 Canadian real estate managers, 1986-1996 (D)	Appraisers place reliance on previous appraised values by assigning weights to the previously used overall capitalization rate.	EM A
Hendershott and Kane (1995)	Russell-NCREIF Property Index 1982-1991 (A)	They found over-statement of return in the index and concluded that it is the results of appraisal smoothing	EM A
Lai and Wang (1998)	--	Argued that appraisal-based returns can be more volatile than true property returns. There is little direct empirical support for the quantitative partial adjustment model that underlies the unsmoothing methodology. They found that the mean returns over the period are virtually identical.	TH T+A
Levy and Schuck (2005)	Semi-structured interviews with 7 clients in New Zealand	Appraisals are influenced by clients	EX

Miles et al. (1990)	Hedonic pricing analysis on different real estate sectors of US in 1980-1988	Found evidence that hedonic returns exhibit greater volatility than appraisal-based returns. For retail, the mean value-weighted transactions return was 2.3% as opposed to 3.1% for the appraisal-based return. For office properties, the appraisal-based return underestimated actual mean return by 0.3%, a 10% bias in estimated average annual performance over an 8-year period	EM T+A
Quan and Quigley (1991)	--	Developed a theoretical model in which smoothing at the individual property level can result from rational appraiser behaviour.	TH
Webb (1994)	569 transactions NCREIF index 1978-1992 (D)	Transaction prices were on average 0.5% higher than appraised values, but insignificant. During rising market, a positive 7.8% difference; during flat market, a positive 2.3% difference; during declining markets, a negative 3.3% and 4.9% difference	EM T+A