

# Alternative Theories of Appraisal Bias

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## Abstract

*This paper reviews the literature on appraisal bias and summarizes three hypotheses for systematic bias: behavior contention, options-value, and different-base-of-valuation. A case study based in Hong Kong is presented that portrays empirical evidence of appraisal bias in land premiums. Land premium appraisals are analyzed because they can help keep the depreciation factor constant and provide good pairs of transaction price and estimate. These appraisals are collected from published estimates, 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 is found in appraisers' estimates against the final bid prices. Although it can be explained plausibly by appraiser-behavior contention, there is also empirical evidence supporting the other two hypotheses.*

Although appraisal bias has been intensively studied since the 1990s, random bias and systematic bias are not well differentiated, but inextricably intertwined. Systematic bias is defined as a persistent over- or under-estimation of property value. The dominant study on appraisal bias, however, is on random bias. Random bias is mainly produced by appraisal smoothing (downside bias of variance), which is commonly explained by valuation timing and adaptive behavior. Systematic bias, on the other hand, has been explained by behavioral contention, such as the client's influence and the minimization of the cost of justifications.

Systematic bias in property and land appraisals is of paramount importance to stakeholders of real estate markets. The problem does not lie on the bias itself, but on the persistence. Since random bias is ubiquitous and does not greatly affect investors' decisions, provided that the margin of error is small. However, systematic bias will seriously affect investors' judgments and benefits.

The aim of this paper, besides reviewing the literature on appraisal bias, is to put forward two more alternative hypotheses, which can well explain the systematic bias in land premium appraisals. These two hypotheses are testable and have empirical evidence, while behavioral theories are mostly tested experimentally. It requires, however, further critical tests to identify which explanation is correct.

The arrangement of this paper is as follows. First there is a systematic review of the literature on appraisal bias and on the other two hypotheses. Next, the case study on land premium appraisals in Hong Kong is presented, which include the background

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of land premium appraisals in Hong Kong along with the data and results of the persistent under-estimation of land premium. There is then a discussion of the phenomenon via the three hypotheses along with the empirical evidence. The paper then closes with concluding remarks.

## Literature Review

Exhibit 1 illustrates the hierarchy of the alternative explanations of appraisal bias. Random bias versus systematic bias is differentiated. However, appraisers' behavior is not the only cause of systematic bias.

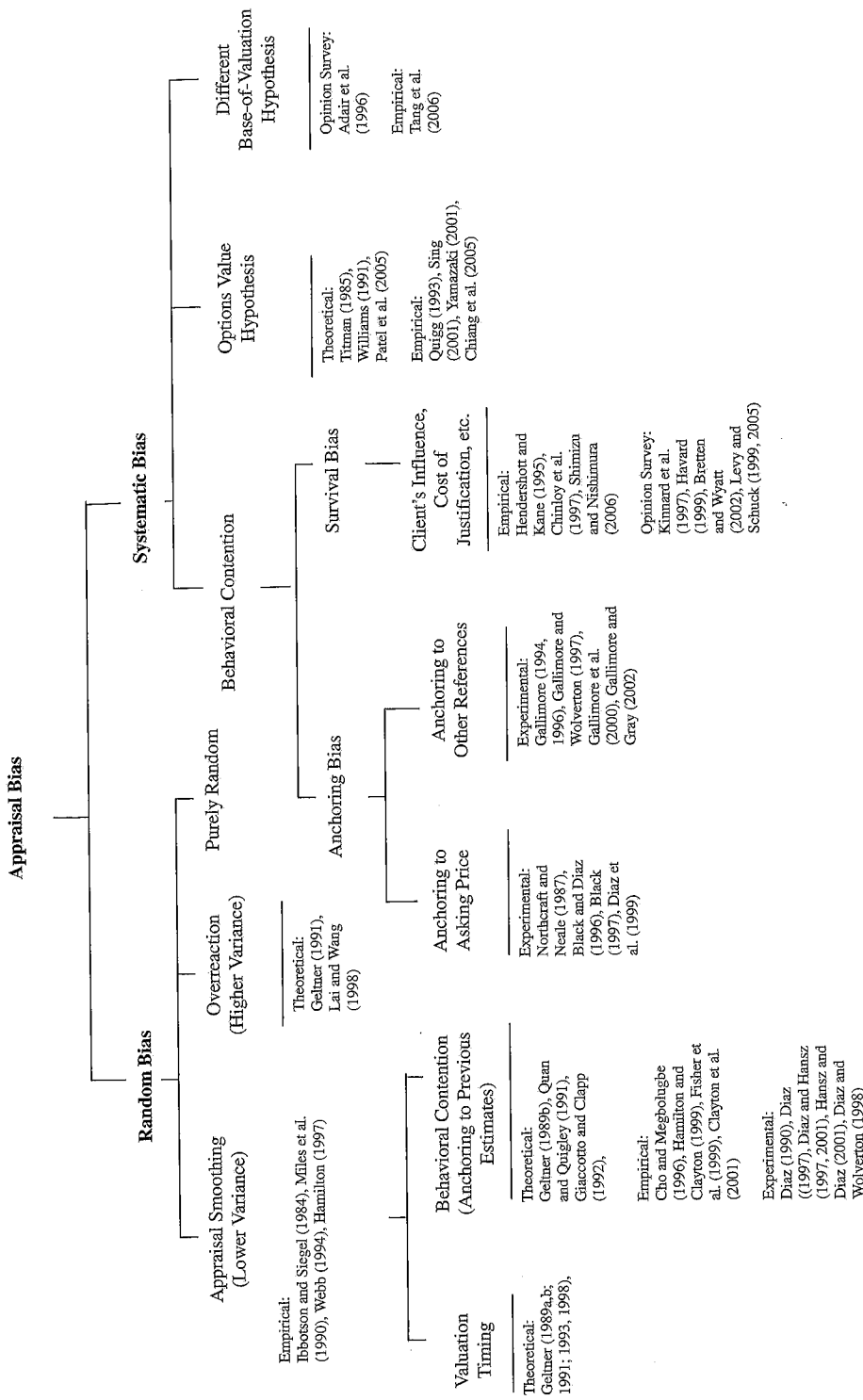
A large number of studies revealed random bias (variance in property appraisals) and found about 5%–10% average margin of error between sale price and appraised value (Matysiak and Wang, 1995; Hutchison et al., 1996; and Brown, Matysiak, and Shephard, 1998). Since appraisals involve uncertainty, a random margin of error in appraisals is totally understandable and inevitable. Judgments in the courts in the United Kingdom also reflected that a 10%–15% margin of error in valuation is accepted (Crosby, Lavers, and Murdoch, 1998).

Geltner (1998) described that the margin of error is explained by three causes: (1) appraisal smoothing (downside bias of variance); (2) overreaction (upside bias of variance); and (3) purely random error (noise). Almost all studies on the random bias in appraisals predict a downward biased variance estimate (i.e., appraisal smoothing), except Lai and Wang (1998). Empirical evidence of appraisal smoothing was found in Ibbotson and Siegel (1984), Miles, Cole, and Guilkey (1990), Hendershott and Kane (1995), and Hamilton (1997), to name just a few. The smoothing bias is further explained in Geltner (1989a) by valuation timing and appraisers' adaptive behavior. Geltner's (1993) temporal aggregation argument and Brown and Matysiak (2000) illustrated the former explanation. Geltner (1989b, 1989c, 1991, 1993), Quan and Quigley (1991), and Giaccotto and Clapp (1992) explored the latter. Exhibits 2 and 3 show a summary of these studies, organized to group together the studies shown in Exhibit 1.

Further examination of appraisal smoothing revealed that appraised values tend to lag the market price. For example, Webb (1994) and Fisher, Miles, and Webb (1999) found that appraisers underestimate value in rising markets and overestimate in falling markets. These phenomena were explained by Quan and Quigley's (1991) hypothesis on rational appraisal weighting on previous estimates (i.e., behavioral anchoring to previous estimates). It ignited the flame of research on behavioral science in appraisal bias. Other empirical evidence of temporal lag and appraisal weighting on previous estimates include Cho and Megbolugbe (1996), Hamilton and Clayton (1999), and Clayton, Geltner, and Hamilton (2001).

Research on behavioral influences has been gaining momentum. Since Slovic and Lichtenstein (1971), Tversky and Kahneman's (1974) and Kahneman and Tversky's (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-

**Exhibit 1**  
**Alternative Explanations of Appraisal Bias**



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**Exhibit 2  
Literature Review on Appraisal Bias—Random Bias**

Paper	Data Descriptions and Methodology	Results
<b>Panel A: Appraisal Smoothing (Lower Variance)</b>		
Empirical		
Miles, Cole, and Guilkey (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.
Webb (1994)	Empirical study on 569 transactions NCREIF index 1978–1992.	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.
Hamilton (1997)	Empirical study on 250 properties sold, Russell Canadian Index 1985–1995.	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. Appraisal smoothing evidence was found.
<b>Panel B: Appraisal Smoothing (Lower Variance)—Valuation Timing</b>		
Theoretical		
Geltner (1989a)	Theoretical and empirical study on 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).	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.

**Exhibit 2 (continued)**  
**Literature Review on Appraisal Bias—Random Bias**

Paper	Data Descriptions and Methodology	Results
<b>Panel B: Appraisal Smoothing (Lower Variance)—Valuation Timing (continued)</b>		
Geltner (1989b)	Theoretical study of appraisal smoothing.	Offered lack of confidence and valuation timing as two possible explanations of the phenomenon of appraisal smoothing.
Geltner (1993)	Theoretical study of appraisal smoothing.	Argued that the difference in the timing of appraisals and the interval of the index will also cause an under-estimation of its variance.
<b>Panel C: Appraisal Smoothing (Lower Variance)—Behavioral Contention (Anchoring to Previous Estimates)</b>		
<b>Theoretical</b>		
Quan and Quigley (1991)	Theoretical study	Developed a theoretical model in which smoothing at the individual property level can result from rational appraiser behavior.
<b>Empirical</b>		
Giaccotto and Clapp (1992)	Monte Carlo Simulation	Exponential smoothing and Kalman filter rules perform well.
Cho and Megbolugbe (1996)	Empirical study on 600,000 mortgages purchased by Fannie Mae in 1993.	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.
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.
Fisher, Miles, and Webb (1999)	Empirical study on 2,739 transactions of properties sold in the NPI from 1978 to 1998.	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.

**Exhibit 2 (continued)**  
**Literature Review on Appraisal Bias—Random Bias**

Paper	Data Descriptions and Methodology	Results
<b>Panel C: Appraisal Smoothing (Lower Variance)—Behavioral Contention (Anchoring to Previous Estimates) (continued)</b>		
Clayton, Geltner, and Hamilton (2001)	Individual appraisal reports in two Canadian real estate managers, 1986–1996.	They found temporal lag bias in appraisals and appraisers put about 20% of weight on their previous valuation in reappraisal.
Experimental Diaz (1997)	Experiment on valuing a piece of land in the U.S.	No evidence that expert appraisers operating in geographic areas familiar to them were influenced by the previous value judgments of anonymous experts.
Diaz and Hansz (1997)	Experiment on valuing a piece of land in the U.S.	In contrast with Diaz (1997), appraisers who were unfamiliar with the markets were influenced by previous value judgments.
Diaz and Hansz (2001)	Experiment on valuing a piece of land in the U.S. (87 appraisers).	Confirmed the findings in Diaz (1997) and Diaz and Hansz (1997).
Hansz and Diaz (2001)	Experimental study on the effect of market feedback on appraisal prices.	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.
Diaz and Wolverton (1998)	Experiment on 31 expert appraisers in Atlanta in 1995.	They found evidence that appraisers are significantly influenced by their own previous appraisal.
<b>Panel D: Overreaction (Higher Variance)</b>		
Empirical Geltner (1991)	Theoretical study of appraisal smoothing.	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).

**Exhibit 3**  
**Literature Review on Appraisal Bias—Systemic Bias**

Paper	Data Descriptions and Methodology	Results
<b>Panel A: Behavioral Contention: Anchoring Bias—Anchoring to Asking Price</b>		
Experimental Northcraft and Neale (1987)	Experiments on 48 students and 21 real estate agents.	Both experts and novices anchored on the listing price.
Black and Diaz (1996)	Controlled negotiating experiment in Georgia State.	Property professionals and students gave inappropriate weights to asking prices.
Black (1997)	Controlled negotiating experiment with information-rich market environment in Georgia State.	Negotiators who are trained as deal makers will anchor on the asking price of real property, but more accessible information may mitigate anchoring bias.
Diaz, Zhao, and Black (1999)	Experiment on 30 student valuers in Georgia State.	Students anchored to asking prices in negotiation even with contingent reward.
<b>Panel B: Behavioral Contention: Anchoring Bias—Anchoring to Asking Price—Anchoring to Other References</b>		
Experimental Gallimore (1994)	Questionnaire survey of 276 respondents.	Heuristic bias and recency effect were found in the valuation of real estate assets.
Gallimore (1996)	Experiment on appraising property value of 172 appraisers in the UK.	Revealed that appraisers of residential property were aware of pending sale price 67% of the time.
Gallimore and Gray (2002)	Questionnaire survey on 218 property investment decision makers in the UK in Feb 2000.	Investor sentiment, including views of commentators, is an important factor in making property investment decisions.
Gallimore and Wolverton (1997)	Experiment on appraising property value of 32 appraisers in the US and UK.	Revealed that appraisals were biased by knowledge of the pending sale price.
Gallimore, Hansz, and Gray (2000)	Semi-structured interviews with 13 property investment companies in the UK.	Small investors weight heavily on private information passed on through market contacts, leading potentially to availability biasing and over reaction.

**Exhibit 3 (continued)**  
**Literature Review on Appraisal Bias—Systemic Bias**

Paper	Data Descriptions and Methodology	Results
Panel C: Behavioral Contention: Survival Bias—Client's Influence, Cost of Justification, etc. Empirical Hendershott and Kane (1995)	Empirical study on Russell-NCREIF Property Index 1982–1991.	They found over-statement of return in the index and concluded that it is the results of the reluctance of appraisers to change values sharply and incentives that investment managers have to maintain the values upon which their percentage fees are based.
Chinloy, Cho, and Megbolugbe (1997)	Empirical study on 600,000 mortgages purchased by Fannie Mae in 1993	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.
Shimizu and Nishimura (2006)	Empirical study on the valuation errors of the published land price information in Tokyo metropolitan area in Japan from 1975 to 1999.	Found 20% overestimation of the published land price index over the transaction one. They conjectured that it was due to the political pressure on the appraisal committee who prepared the published price index when price fell.
Opinion Survey Havard (1999)	Experiment on 30 student valuers in Nottingham	Student valuers had greater tendency to adjust the valuation upward than downward when they had information of previous valuation.
Bretten and Wyatt (2002)	Questionnaire survey to 220 stakeholders in the UK.	60% of valuers agreed that they would increase their valuation figure if external parties exerted pressure to do so.
Levy and Schuck (2005)	Semi-structured interviews with 7 clients in New Zealand.	Appraisals are influenced by clients.



**Exhibit 3 (continued)**  
**Literature Review on Appraisal Bias—Systemic Bias**

Paper	Data Descriptions and Methodology	Results
Panel D: Options Value Hypothesis		
Theoretical Titman (1985)	Theoretical modeling to provide a valuation equation for pricing vacant land lots.	Uncertainty increases the value of option to wait. One implication is that increased uncertainty leads to decrease in construction activities in the current period.
Williams (1991)	Development of a model to solve analytically and numerically the option pricing problem.	Optimal exercise policies were computed analytically and numerically for the options to develop or to abandon real estate. The paper assumes that owner can determine the density or scale at which to develop his property, and both revenues and costs evolve stochastically through time.
Patel, Paxson, and Sing (2005)	A general review of real property options classified into six primary practical uses: planning, investment timing, leasing, operations, funding, and industry strategy.	Concluded that there would be more new models developed. There were, however, several 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.
Empirical Quigg (1993)	An empirical examination of the value of option to wait to develop land. The option premium was derived as the difference between the option model value and the intrinsic value of land parcels.	Market prices reflected a premium of 6% of the land value, on average, for the option to wait to invest.
Sing (2001)	Followed Quigg's specifications and empirically estimated the values of options based on the commercial property transaction data in the UK. However, the study simplified Quigg's model to a one stochastic variable on rental income by assuming deterministic development cost. The study also assumed zero income of undeveloped land.	Based on one case study, the study found a positive and significant option premium. Also, sensitivity analysis showed that as rental incomes increased, the option premium decreased, indicating that developers had less incentive to wait to develop land when unit rent increased.

**Exhibit 3** (continued)  
**Literature Review on Appraisal Bias—Systemic Bias**

Paper	Data Descriptions and Methodology	Results
Panel D: Options Value Hypothesis (continued)		
Yamazaki (2001)	<p>Tested the option value of land in Central Tokyo by regressing 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.</p>	<p>Total uncertainty had a substantial effect on the price of land. An increase in uncertainty led to a corresponding increase in land prices.</p>
Chiang, So, and Yeung (2005)	<p>Generally replicated Quigg's specification to derive land prices from both their option model and traditional hedonic pricing model, based on records of land auction and property transactions in Hong Kong,</p>	<p>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 increased during market recessions, when developers placed higher value on the option value.</p>
Panel E: Different-Base-of-Valuation Hypothesis		
Adair, Berry, and McGreal (1996)	<p>Opinion surveys on 76 valuers and 506 home purchasers in the eastern sector of Belfast on the importance weightings of price influencing factors.</p>	<p>Buyers and valuers perceive differently the relative importance of price influencing factors.</p>
Tang, Yiu, Chiang, and Choy (2006)	<p>Empirical study on the developed floor areas of 23 auction sites sold by the government between 1991 and 1995 in Hong Kong.</p>	<p>Saleable floor areas of these developments exceed lease restrictions by 10.1% on average.</p>

documented patterns of human reactions to the context, reference points, mental categories, and associations that influence how people make decisions," (Shiller, 2003: 13). Behavioral contention has been widely applied in explaining phenomena in financial markets (Schacter, Ouellette, Whittle, and Gerin, 1987; Daniel, Hirshleifer, and Subrahmanyam, 1998; Thaler, 1999; Dremen and Lufkin, 2000; and Shleifer, 2000). De Bondt (1998) offered a brief survey of prior research of behavioral finance.

Julian Diaz III adopted an experimental approach and embarked a line of behavioral property research on Quan and Quigley's hypothesis. Diaz (1990, 1997), Diaz and Hansz (1997, 2001), Hansz and Diaz (2001), and Diaz and Wolverton (1998) tested the contention that appraisers anchored to their previous estimates. This contention has been confirmed in almost all their studies, except Diaz (1997) where he argued that appraisers familiar with the market did not anchor.

Besides previous estimates, Paul Gallimore found a lot of other points of reference in appraisal anchoring. He also adopted the experimental approach and found that appraisers were significantly influenced by other points of reference, such as commentators' view, pending sales price, previous transaction price, etc. These studies include Gallimore (1994, 1996), Gallimore and Wolverton (1997), Gallimore, Hansz, and Gray (2000), and Gallimore and Gray (2002). Hardin (1997) also obtained similar results in lending institutes. However, it has not been demonstrated that some of these points of reference may result in systematic bias.

Indeed, the first behavioral anchoring study on real estate appraisal was one on anchoring to asking price. Northcraft and Neale (1987) investigated experimentally the anchoring behavior of real estate brokers on property pricing decisions. They found persistent anchoring to asking price in their estimates. Roy Black further pursued this point and showed significant anchoring to the asking price in Black and Diaz (1996), Black (1997), and Diaz, Zhao, and Black (1999). Such bias is very unlikely to be random, as asking price is prone to be higher than the market price.

Another source of systematic bias is the 'survival bias' as coined by Kishore (2006). It includes client's influence and the minimization of justification costs in appraisals. This bias is systematic in nature. For example, Kinnard, Lenk, and Worzala (1997) surveyed appraisers in the United States and found that they might change their appraisals in response to client pressure. Bretten and Wyatt (2002:11) carried out a questionnaire survey to 220 stakeholders in the United Kingdom and found that "sixty per cent of valuers would increase their valuation figure if external parties exerted pressure to do so." Levy and Schuck (1999, 2005) also conducted interviews with property executives in New Zealand and concluded that valuations were greatly influenced by clients. Havard (1999) also found that appraisers tended to adjust estimates upwards rather than downwards.

However, almost all of these behavioral studies are experimental or opinion surveys rather than empirical in nature. The difficulties in conducting direct empirical studies on this behavioral contention are understandable. As Kishore (2006:10) stated that the survival bias to a certain extent "renders unethical valuer behavior, as opposed to

being seen as a cognitive behavioral bias." For example, Chinloy, Cho, and Megbolugbe (1997) examined 600,000 mortgages purchased by Fannie Mae in 1993 and found that the lower the loan-to-value ratio, the more likely the appraised value was below the pending sale price. They explained the phenomenon by arguing that appraisers faced an asymmetric cost function such that a below-pending-sale-price appraisal incurred much higher costs of justification; thus, it led to a systematic upward appraisal bias in mortgage purchases. Yet, this empirical result provides no critical test on the behavioral contention, and the explanation remains a conjecture.

### *Alternative Explanations*

This behavioral contention is, however, hard to test empirically. Furthermore, there are other alternative explanations that can also tenably explain systematic appraisal bias and they have empirical evidence in the following land premium study too. This paper puts forward two alternative explanations: the options-value hypothesis and the different-base-of-valuation hypothesis.

*Options-Value Hypothesis.* Real options value in land development has been well established in Titman (1985) and Williams (1991) and there have been numerous studies on land development options. At least four empirical studies on land development options are available; they are Quigg (1993), Sing (2001), Yamazaki (2001), and Chiang, So, and Yeung (2006) 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 empirically tested 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 U.K. However, Sing simplified Quigg's model to a one stochastic variable on rental income by assuming deterministic development cost. He also assumed zero income from 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, So, and Yeung (2005) further modified the model of Quigg (1993) to formulate their option model in the Hong Kong land market. A comparison among

land prices derived from their model suggested that land auction prices had imbedded option value.

In practice, real options price is not commonly estimated in land value appraisal. As Patel, Paxson, and Sing (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 persistent under-estimations in land premium may reflect the options value possessed by the bidders. Appraisers who estimate land premium based on normative valuation methods or the hedonic pricing model may not have taken into account of the options value, which developers have somehow allowed for in their bids.

*Different-Base-of-Valuation Hypothesis.* Another tenable hypothesis to explain the systematic appraisal bias of land premium lies in the different decision models adopted by the appraiser vis-à-vis the buyer. This hypothesis is in line with Adair, Berry, and McGreal's (1996) findings that appraisers and buyers consider different factors in appraisal. We postulate that appraisers and buyers follow different models in deriving their respective estimates of land value. The differences lie in how they process the data, and 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 buyers are inclined to adopt a "three-dimensional" approach determining a value (or range) of land premium they find acceptable for the site. This approach not only considers technical and institutional development constraints of the site in greater detail, but also contains a certain degree of deliberation about the 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. It is reasonable and indeed professional that appraisers do not take such an approach, because the primary role of an appraiser is to project the "market value" of the land sale, and not the "buyer value." The principal assumption adopted by appraisers is to derive the market value such that there are 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 training that refrains the appraisers from considering these special interests when they assess the fair "market value."

Contrarily, buyers can achieve a higher property price if they optimize the 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. 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 it is hard for appraisers to know.

## **A Case Study of Land Premium Appraisals in Hong Kong**

This paper presents a case study that takes place in Hong Kong and considers land premium appraisal bias. It provides empirical evidence on the three alternative hypotheses.

### *Current Practice of Land Premium Appraisal*

Land premium appraisals are chosen because they possess the following advantageous characteristics over property appraisals. First, the pairing of transaction price with appraisal value is readily available in news reports and the transactions are normally engaged just after a few days of the appraisals. Second, the factors of depreciation and asset conditions can be ignored in land appraisals. Lastly, the appraisals are conducted by various independent consultants and professionals. In other words, the principle-agent issue and the peculiarities of some appraisers can be removed.

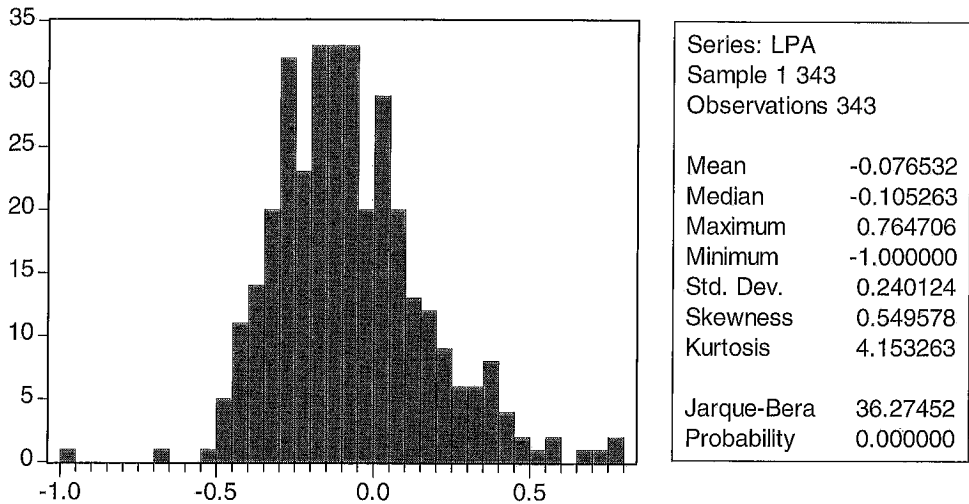
According to the Guidance Notes of the Royal Institution of Chartered Surveyors, UK, land value appraisal is commonly carried out by the residual valuation method. Land price is equal to the market price of the property to be developed less the construction cost, interest cost, gross development profit,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

Land auction in Hong Kong has been conducted for more than 150 years. All land is sold at auction includes leasehold interests and land use rights. The entire 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 on the government homepage well before the auctions. The mass media closely monitor the process and the results. Various independent appraisers are often invited to give estimates, which are 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 U.S. 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. Thus, relevant information is efficiently distributed almost at no cost; a consistent under- or over-estimation of the bid prices by appraisers, if any, needs to be explained.

### *Data and the Bias*

Three hundred forty-three appraisals of land premium for 109 auctions of land in Hong Kong from 1991 to 1999 were collected. The appraisals and the bid prices were collected from the reported estimates and transacted prices in the newspapers, which eliminate the client-agent heuristic. Exhibit 4 shows the frequency distribution and

**Exhibit 4**  
**Frequency Polygon of the Differentials (Differences between Appraisals and Actual Bid Prices)**



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.

By means of a simple *t*-test, Exhibit 5 shows that the appraisals are statistically significantly downward biased by about 8% at the 1% significance level. The persistence of this systematic downward bias in appraised value has also been shown by extending the series further to the 1993–2005 period (Man and Ng, 2006), where an underestimation of 15% was found in the appraisals.

This difference cannot be explained by professional knowledge as there was no significant difference between the estimates of surveyors and that of non-surveyors (e.g., real estate agents) in the sample; there were 230 estimates by surveyors and

**Exhibit 5**  
***t*-test Results of the Differentials**

Hypothesis Testing for LPA  
 Sample: 1 343  
 Included observations: 343  
 Test of Hypothesis: Mean = 0.0000  
 Sample Mean = -0.0765  
 Sample Std. Dev. = 0.2401

Method	Value	Probability
<i>t</i> -Statistic	-5.9028	0.0000

113 estimates by non-surveyors. The averages of their differentials are  $-7.4\%$  and  $-8.2\%$  respectively, but the difference is not statistically significant as shown in Exhibit 6.

In Exhibit 7, Panels A and B show the frequency polygons and summary statistics of the two subgroups: surveyors and non-surveyors respectively. Panel C 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).

### *Behavioral Contention*

In line with the findings of Gallimore and Gray (2002), this systematic bias can be very plausibly explained by behavioral contention. Since 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 a coalition, called a growth machine, is backed by corporate capital and government,

**Exhibit 6**  
***t*-test Result of the Equality of Means of the Differentials between Surveyors and Non-surveyors**

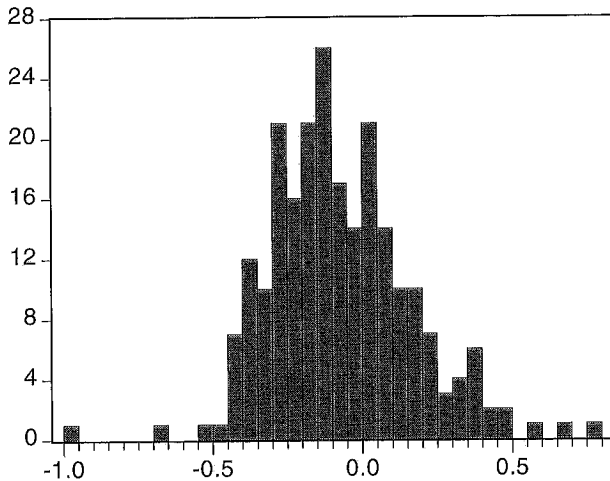
Method	df	Value	Probability	
<i>t</i> -test	341	0.2851	0.7758	
ANOVA F-Statistic	(1,341)	0.0813	0.7758	
Analysis of Variance				
Source of Variation	df	Sum of Sq.	Mean Sq.	
Between	1	0.0047	0.0047	
Within	341	19.7149	0.0578	
Total	342	19.7196	0.0577	
Category Statistics				
Surveyor	Count	Mean	Std. Dev.	Mean
0	113	-0.0818	0.2501	0.0235
1	230	-0.0739	0.2356	0.0155
All	343	-0.0765	0.2401	0.0130

Notes: Categorized by values of surveyor. Sample size = 1,343.



### Exhibit 7 Frequency Polygon and Box-Plots of the Differentials for Surveyors and Non-Surveyors

#### Panel A

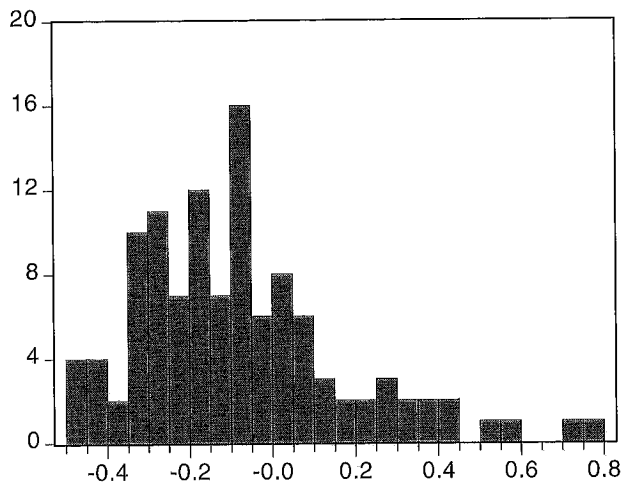


Series: LPA  
Sample 1 343 IF SURVEYOR  
= 1  
Observations 230

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

#### Panel B



Series: LPA  
Sample 1 343 IF SURVEYOR  
= 0  
Observations 113

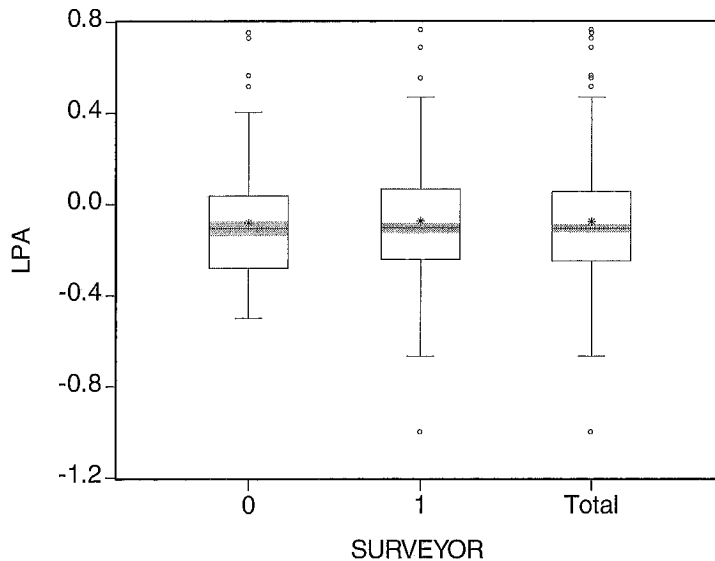
Mean -0.081813  
Median -0.106250  
Maximum 0.750000  
Minimum -0.500000  
Std. Dev. 0.250069  
Skewness 0.932640  
Kurtosis 4.067703

Jarque-Bera 21.74900  
Probability 0.000019

which are supportive to local economic growth (Logan and Molotch, 1987; Molotch, 1993; and Harding, 1994). The property market has a disproportionate weight in the Hong Kong economy, which is described by Haila (2000) as a "property state." Government land auction is relied on as a barometer of confidence in a local economy because government officials, local media, and professionals have all wished the public to see it that way:

**Exhibit 7** (continued)  
**Frequency Polygon and Box-Plots of the Differentials for Surveyors and Non-Surveyors**

**Panel C**



“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.” *South China Morning Post*, August 23, 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*, August 28, 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*, August 16, 1996.

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 estimate based on a normative model 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.<sup>1</sup>

### *Option-Value Hypothesis*

Chiang, So, and Yeung (2005) retrieved records of land auction and corresponding property transactions in Hong Kong for their option-value analysis. They derived land prices from both their modified options model and the traditional hedonic pricing model. A comparison between the land prices derived from the two models suggested that land auction prices had imbedded option value. They also found that the option premiums increased with implied volatilities that went up during market recessions, when developers placed higher value on the option value. Interestingly, their estimate of the options value comes close to our estimate of the appraisal bias in the case study.

### *Different-Base-of-Valuation Hypothesis*

A simple test to determine the difference in land premium appraisal between appraisers and buyers is concerned with the total floor area to be developed on the site. A government lease stipulates the maximum permissible amount of gross floor area (GFA) on every auction site. This is an important figure that determines the development intensity of the site and constitutes the key basis for land value assessment by developers. However, it is wrong to believe 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 the maximum GFA allowed under the lease. To what extent a developer could utilize such a floor space exemption depends on the building design for the project. There is, therefore, an incentive for developers to consider physical project design at the pre-auction stage in ascertaining how much extra floor space they could ultimately get from the site.

Appraisers, on the contrary, would not consider architectural design during land premium appraisals. Conventional education and training encourages appraisers to emphasize numerical data rather than architectural design. Thus, they tend to have less incentive as well as ability in evaluating possible development designs 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 developer 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."

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In fact, the amount of saleable floor space after project completion quite often exceeds the maximum permissible GFA under the lease. Based on a sample of 23 auction sites sold by the government between 1991 and 1995, Tang, Yiu, Chiang, and Choy (2006) found that the saleable floor areas of these developments exceeded lease restrictions by 10.1%, on average. This persistent and positive excess on developed areas provide important empirical evidence on the different-base-of-valuation hypothesis.

## Conclusion

Appraisal bias has been intensively studied, although there are few critical tests on the alternative explanations of systematic bias. Instead, many studies have relied on behavioral contention, which is hard to test empirically. Behavioral contentions are supported mainly by experiments and opinion surveys rather than empirical tests. Furthermore, many other alternative explanations are ignored in the literature.

The study of appraisal bias is difficult because the pairing of transaction price with estimates is not at fixed intervals, which does not keep other things equal. We, however, study the disaggregate price of land as an empirical test of appraisal bias. We found an 8%–15% persistent 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 that shows an appraisal downward bias, *ceteris paribus*. This finding can be plausibly explained by a behavioral contention as an under-estimation of land premium that can produce a prosperous market sentiment, which benefits the appraisers themselves. However, before jumping into this conjecture, two alternative explanations are put forth that also have empirical evidence. The three hypotheses are: (1) the behavior-contention; (2) the options value hypothesis; and (3) the different-base-of-valuation hypothesis. More studies are needed critically test these three hypotheses.

## Endnote

1. Neil Crosby, the chairman of our conference session, suggested another plausible behavioral contention that bidders might be framed by the appraisals, thus resulting in the bias. We thank him for his inspiring comments.

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