

# **An empirical analysis of valuation accuracy and variation– Hong Kong evidence**

KF Man<sup>1</sup>, Angel Ng<sup>2</sup>

## **Abstract**

Being active players in the real estate market, valuers and their valuations play an important role in the pricing decisions used for real property transactions. In this study, we shall examine empirically the accuracy of the valuations produced by valuers in a particular situation: the auctioning of vacant land by the Hong Kong Government for development purposes. Previous studies on valuation accuracy dealt with investment properties only.

Data for the analysis is taken from public records. Regression analysis is employed to analyze the data. We found that both public and private sector valuers consistently produced valuations that differed from the actual transacted prices, with the private sector valuers performing better. Amongst the private sector valuers, the variation in estimation of values relative to the transaction price falls outside a 20% band seventy percent of the time, due to the high volatility of the market during the sample period

Key words: Valuation accuracy, valuation variation

<sup>1</sup>The Hong Kong Polytechnic University

<sup>2</sup>Rating and Valuation Department, the HKSAR Government

## **Introduction**

It is observed that during the public auctions of government land for development purposes, the transacted price habitually goes beyond the most optimistic prices predicted or estimated by the valuers in town, when the market is in the upswing. One of the most recent case being a site in Kowloon Bay which was auctioned off at \$1.82 billion whilst the most optimistic estimated value, as revealed in newspapers before the auction, was around \$1.2 billion only. With the discrepancy being more than 50% which translates into a hefty \$620 million, one cannot help but ask the question: are the developers insane?

There may be various reasons behind this phenomenon. A popular explanation is that developers are bullish on the future market of units to be completed in a few years time. Another explanation usually put forward is that it is out of strategic considerations. The successful bidder (developer) of the auction may have a large land holding in the area and by achieving a higher level of land price; it would boost the overall value of his portfolio. However, one reason that has never been admitted by valuers is that their valuation tools may not be good enough for the valuation of this type of property (vacant developable land). The traditional valuation methods for valuing this type of property are the residual method of valuation and the method of discounted cash flow. The latter, a refined method of the former, borrowed from the field of finance, can handle the timings of the relevant cash flows in a better way.

## **Literature review**

The question of valuation accuracy and variation was first brought up by the surveying profession back in the mid mid-seventies in professional journals (Greenwell et.al., 1976; Trott, 1980; Heselgrave, 1983). However, it was not until an actuary named Hager openly challenged the subject that the matter came under heated discussion. In his paper, Hager (1985) identified ‘the most usual methods adopted by the surveyor in valuing investment properties and the principal factors on which the surveyor is required to reach a subject judgment’ and by so doing, he was able to conclude that variation in valuations prepared by different surveyors was a natural consequence and the ‘range of valuations for any particular property would be about 5% either side of the average value’.

As investments in property made by institutions continue to grow, the performance of the relevant asset, i.e. property, comes under closer scrutiny; as it has a direct link with the performance of the fund managers. The property market is not only notorious for its illiquidity as compared with other asset markets such as stock and bond market, its estimated values are generally made on a subjective basis. In a nutshell, the determination of price for a piece of real estate would be on an appraisal rather than a transactional basis most of the time. As ‘property valuations on a consistent and objective basis are not available’, Hager therefore cast a doubtful eye on the measurement of performance of investment properties.

Brown (1985) used regression analysis to test the hypothesis that “valuations act as a good proxy for prices ... over a random sample of 29 properties over the period of 1975-80 covering a broad spectrum of types and quality”. The resulting R-squared value was 99% and it indicated that prices explained about 99 per cent of their equivalent valuations. Lizieri et. al. (1991) however suggested that the closed institutional structure of the property market tends to make the valuation – price relationship a self-fulfilling prophecy. He suggested that valuations should be “forward looking, analytic and explicit in their assumptions and valuers should seek to widen the set of information used to arrive at an appraisal.”

As regards to valuation variation, Matysiak and Wang (1995), based on the study of 317 randomly selected investment properties between the years of 1973 and 1991, obtained the following results on the relationship between valuation and prices :

<b>SELLING PRICE</b>	<b>PROBABILITY</b>
Within +/- 10% of the Valuation	30%
Within +/- 15% of the Valuation	55%
Within +/- 20% of the Valuation	70%

Apart from the above quoted literature, studies on valuation or appraisal accuracy have been pursued in the US (e.g. Webb 1994; Fisher, Miles and Webb, 1999; Clayton, Geltner and Hamilton, 2000), the UK (e.g. Blundell and Ward, 1997; Drivers Jonas/IPD, 1997) and Australia (Parker, 1998; Newell and Kishore, 1998). All these studies however concern valuations of investment properties only. Valuation accuracy itself is a wider issue and may entail different considerations for different real estate environments (real estate segments). Gallimore (2002) has rightly pointed out that ‘even within discrete property types, sub-markets exist, although specifying the boundaries of these sub-markets, even where they are stable over time, is not always easy.’

As far as the authors are aware of, there has never been any study on valuation accuracy and variation problem for vacant (raw) land for development purposes. This is the first study in this area.

## Methodology

It is understood that valuers within Lands Department of the HKSAR Government will carry out an updated valuation on the morning of an auction date and come up with an upset price, which typically is their estimation of the market value of the subject on the auction date. Again it is well known that their estimates are prone to err on the low side as that would provide a leeway for the potential bidders and to heat up the auction process.

First, we employed regression analysis to establish the relationship between the transacted price (hereinafter called premium) and the upset price (first regression) and then the relationship between the premium and the estimated value of private sector valuers as a group (second regression). The specifications of the relevant regression equations assume the following form:

$$\text{Premium} = C(1) * \text{Upsetprice}^1 + e_1 \quad \text{and}$$

$$\text{Premium} = C(2) * \text{Surveyor}^2 + e_2$$

$e_1, e_2$  are assumed to be i.i.d.

Secondly, we made use of pair sample regression analysis to test the hypothesis that estimated values made by the private valuers was greater than that estimated by public sector valuers.

<sup>1</sup>Upsetprice = estimate value of subject property by public sector valuers

<sup>2</sup>Surveyor = estimate value of subject property by private sector valuers

## **Data**

All our data come from public sources, either available from government websites, newspapers or from government publications such as Hong Kong Monthly and Annual Digest, Property Review etc.

The private sector valuers' estimated values were obtained from the local newspapers. The press in Hong Kong typically asks the valuers in town for estimated values of sites to be auctioned, mostly during the week before the actual auction dates. This private sector valuation first gained popularity in the early 1990s when property prices started soaring and the auctioning of government land started attracting more public attention. Our data on the private sector valuers' opinion on values were extracted from at least three local newspapers. We found that the data are sometimes incomplete as the answers given by the valuers are sometimes unspecific, particularly in the early years. When the market is volatile, valuers tend to refrain from sharing their opinions on the subject.

There are altogether 169 sites of various designated uses put up for auction in the sample period (1.1.1993 to 31.12.2005). All the site details can be obtained from the sales records file provided by the Lands Department of HKSAR government <http://www.ld.gov.hk>. It covers residential, commercial and industrial uses. A total of 10 sales were withdrawn from auction, because for nine of these the upset price was not met. In the case of the tenth site, it was withdrawn because the successful bidder turned out to be mentally incompetent. As a result of this incident, the procedure for auctioning government land has been modified and all interested bidders have to make a hefty down-payment before they can get a bidding paddle to participate in the bidding process. There were four sites on which no valuer ever made an estimate. There are in total, therefore, 155 data points on which our regression analysis are made.

## Results and Interpretations

The regression results between the transacted price and upset price and private sector valuers' estimate of value are shown in Table 1 and 2 below respectively.

**Table 1**

Dependent Variable: PREMIUM

Method: Least Squares

Date: 01/14/06 Time: 00:15

Sample(adjusted): 1 155

Included observations: 155 after adjusting endpoints

PREMIUM=C(1)\*UPSETPRICE

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.558919	0.026739	58.30106	0.0000
R-squared	0.942938	Mean dependent var	9.29E+08	
Adjusted R-squared	0.942938	S.D. dependent var	1.66E+09	
S.E. of regression	3.96E+08	Akaike info criterion	42.43772	
Sum squared resid	2.41E+19	Schwarz criterion	42.45736	
Log likelihood	-3287.923	Durbin-Watson stat	2.277013	

**Table 2**

Dependent Variable: PREMIUM

Method: Least Squares

Date: 01/14/06 Time: 00:14

Sample(adjusted): 1 155

Included observations: 155 after adjusting endpoints

PREMIUM=C(2)\*SURVEYOR

	Coefficient	Std. Error	t-Statistic	Prob.
C(2)	1.153403	0.023419	49.25061	0.0000
R-squared	0.921407	Mean dependent var	9.29E+08	
Adjusted R-squared	0.921407	S.D. dependent var	1.66E+09	
S.E. of regression	4.65E+08	Akaike info criterion	42.75787	
Sum squared resid	3.32E+19	Schwarz criterion	42.77751	
Log likelihood	-3312.735	Durbin-Watson stat	2.208001	

The relevant regression equations take the following specifications:

$\text{PREMIUM} = 1.558919 * \text{UPSETPRICE}$       and

$\text{PREMIUM} = 1.153403 * \text{SURVEYOR}$

From tables 1 and 2, we can conclude, at a 95% level of significance, the premium and the upset price and private sector valuers' estimate of value are of a high correlation (Adjusted  $R^2$  are of 0.942938 and 0.921407 respectively).

In the second part of our empirical analysis, one tailed paired-sample t test was carried out. The resulting statistical results are shown in Table 3.

**Table 3**

**Paired Samples Statistics**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Surveyor	84225810	155	1357246273.	109016644.05
		5.22		033	8
	Upset Price	61934000	155	1018587735.	81814935.717
		0.00		295	

**Paired Samples Correlations**

		N	Correlation	Sig.
Pair 1	Surveyor & Upset Price	155	.984	.000

**Paired Samples Test**

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Surveyor - Upset Price	22291810 5.223	399929740.8 36	32123129.804	15945924 5.901	28637696 4.544	6.939	154	.000



The above t statistic indicates that we can reject the null hypothesis that the differences between the estimated value of private and public sector valuers (Surveyor-Upset Price) is less than or equal to zero on a 95% significance. This is equivalent to say that the alternative hypothesis is true, i.e. Surveyor >Upset Price.

Next, let's look at the appraisal variation issue amongst the private sector valuers. We have prepared individual appraisal variation diagrams for each and every auction result. A typical one is shown in Figure 1. We plotted 10%, 15% and 20% bands centred at the transacted price and examined how the estimated values of the valuers relate to the plotted bands. The probability of each band is then calculated as a fraction between the numbers of valuers falling within that band in relation to the total number of valuers providing estimates for that auction. We noticed from Table 4, that a substantial number of private valuers' estimates fall outside the 20% band centered from the transacted price. This may be explained by the fact that it is an extremely difficult valuation task as a large number of variables are involved in the residual valuation of vacant land. We show in Table 5 the aggregate performance of the private sector valuers over the thirteen year sample period. On this basis, we conclude that the performance of valuers in Hong Kong, as far as the task of estimating the market value of the auctioned sites is concerned, are mediocre.

Figure 1. Appraisal valuation diagram @ ±10% Level in Year 1993

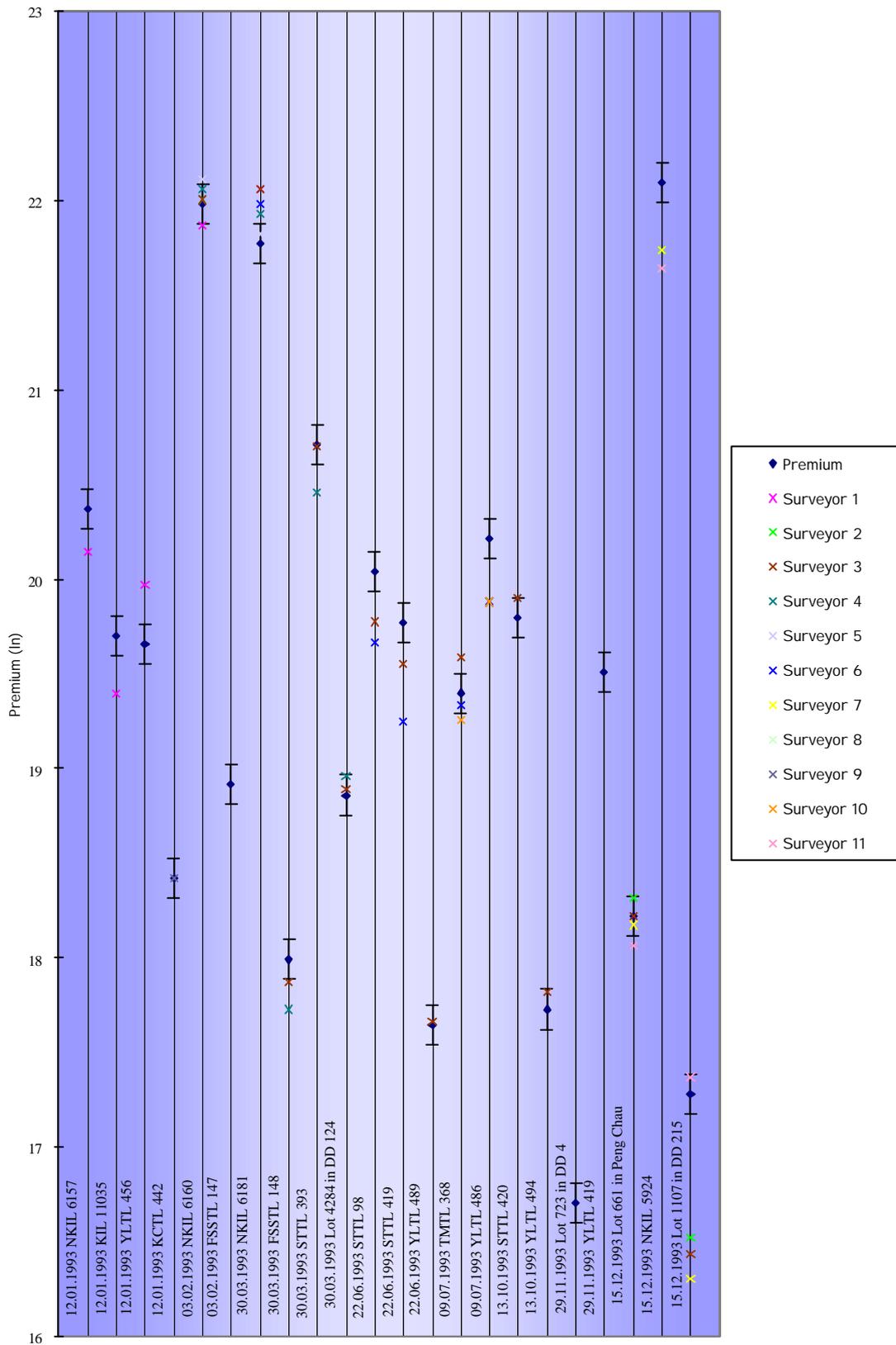


Table 4: Land Valuation Performance between 1993 to 2005

1993	19	4	7	9	21.05%	36.84%	47.37%
1994	20	1	2	6	5.00%	10.00%	30.00%
1995	22	2	6	12	9.09%	27.27%	54.55%
1996	10	0	1	2	0.00%	10.00%	20.00%
1997	18	0	0	2	0.00%	0.00%	11.11%
1998	8	0	0	0	0.00%	0.00%	0.00%
1999	14	0	2	3	0.00%	14.29%	21.43%
2000	14	3	6	6	21.43%	42.86%	42.86%
2001	12	0	1	2	0.00%	8.33%	16.67%
2002	10	0	2	4	0.00%	20.00%	40.00%
2004	5	0	1	1	0.00%	20.00%	20.00%
2005	4	0	0	0	0.00%	0.00%	0.00%

Note: There was no land auction in 2003.

**Table 5**

<b>APPRAISED VALUE</b>	<b>PROBABILITY</b>
Within +/- 10% of the premium	6.41%
Within +/- 15% of the premium	17.95%
Within +/- 20% of the premium	30.13%

As to the 9 unsuccessful auctions, they were marketed during the downswing of the local market and the upset prices could not be met. A careful examination of the estimated values put forward by both public and private valuers reveals that their estimates were quite close. In five cases, the estimates made by private valuers were higher than those made by public valuers whereas the reverse is true in the remaining four cases. Since both public and private valuers use historical sales in their residual and direct comparison valuations, we would argue that the estimated value of vacant land lag behind (hence less than) the true market value (transacted price) when the market is in the upswing. Likewise, the estimated value of vacant land put forward by both public and private valuers lag behind (i.e. are greater than) the true market value when the market is in the downturn.

## **Conclusion**

Our empirical study finds that, when the market was in upswing, the estimated values of the auction sites made by the public and private valuers consistently differed from the actual transacted price by 56% and 15% respectively, on a statistically significant basis. This clearly shows that the estimates of private sector valuers outperform the public sector ones as a whole.

Empirically, the extent of variation of valuation of the private sector valuers is found to be great and certainly falls outside the acceptable range of 20% proposed by Crosby (2000). The discrepancy shown by the public sector valuers could plausibly be explained by the fact that it might be done on purpose, hoping that would produce a sufficiently low platform to facilitate the auction process.

As to the variation amongst the private sector valuers argument, we speculate that this discrepancy may reflect a difference in interpretation of facts in the appraisal process and constraints set by the available valuation methods.

First, it is generally assumed that the previous trend will continue in the valuation process. This is somewhat similar to the technical analysis in the equity market analysis. The projection of the past into the future is good as long as the past trend continues. It will face great challenges when the market is volatile, which is exactly what happened during the sample period.

Secondly, valuers typically use the residual valuation method, coupled with the direct sales comparison method and discounted cash flow method, to estimate the market value of the auction sites. The residual valuation method is notorious for its inaccuracy as too many variables are involved and even a slight difference in the adoption of a set of variables may produce significant variations.

One aspect peculiar to the Hong Kong land auction process is that all the auctioned sites are subject to a building covenant of 2, 3 or 5 years, depending upon the scale of the development. Under the prescribed

building covenant, the developer has to build at least a certain minimum on the site within the prescribed period, failing which the site will be re-entered by government. This effectively means that the successful bidder in the auction acquires a call option (to develop the land) from government. To put it in the phraseology of modern finance for options, he has acquired the option to build by paying the option premium (land price). The time to expire period is the building covenant period and the exercise price is the outlay of construction cost. The underlying security price is the price of the finished building unit. The developer is in the same position of a call option holder. If the market is favorable, he will exercise his option (to build) by incurring the expenses of construction cost so as to have the development completed before the expiry of the building covenant period. On the other hand, if the market turns out to be unfavorable after he has acquired the option, he could simply sit still and let the option expires, in the form of having the land re-entered by the government. On the basis of this new understanding of the nature of land development process, it is suggested that some non-standard valuation methods such as the option pricing model should be used to estimate the land premium amount. This may provide a new direction of research on property valuation method.

## **References**

**Baum, A., Crosby, N., and MacGregor, B., (1995), “Price formation, mispricing and investment analysis in the property market”, *Journal of Property Valuation & Investment*, 1996, 14, p. 36-49**

**Blundell, G.F. and Ward, C.W. R. (1997), “The accuracy of valuations – expectation and reality”, unpublished paper, The University of Reading, England**

**Brown, G. R. (1992), “Valuation accuracy: developing the economic issues”, *Journal of Property Research*, 1992, 9, p.199-207**

**Brown, G. R., Matysiak A., and Shepherd, M. (1997), “Valuation uncertainty and the Mallinson Report”, *Journal of Property Research*, 1998, 15, p.1-13**

**Clayton, J., Geltner D., and Hamilton, S. W. (2000), “Smoothing in commercial property valuations: evidence from individual appraisals”, University of Cincinnati, Department of Finance working paper.**

**Crosby, N. (2000), “Valuation accuracy, variation and bias in the context of standards and expectations”, *Journal of Property Investment and Finance*, 2000, 18(2) 130-161**

**Drivers Jonas/IPD (1997), “The variance in valuations: interim report” Drivers Jonas/ Investment Property Databank, London**

**Fisher, J.D., Miles, M.E., and Webb, R. B. (1999), “How reliable are commercial appraisals? Another look”, *Real Estate Finance*, 16:3, 9-15**

**Gallimore P. (2002), *Real Estate Valuation Theory*, edited by Ko Wang and Marvin L. Wolverton, Appraisal Institute and American Real Estate Society.**

**Greenwell, W. et al. (1976), A call for new valuation methods, Estates Gazette, 238 481-4**

**Hager, D.P. and Lord, D.J. (1985), “The property market, property valuations and property performance measurement”, Institute of Actuaries, London, p.19-50**

**Heselgrave, A. (1983) Are investments worth the price? , Chartered Surveyor Weekly, 10 March 1983**

**Lizieri, C., and Vanmore-Rowland, P., (1990), “Valuation Accuracy: a contribution to the debate”, *Journal of Property Research*, 1991, 8, p.115-122**

**Matysiak, G., and Wang, P., (1995), “Commercial property market prices and valuations: analyzing the correspondence”, *Journal of Property Research*, 1995, 12, p.181-202**

**Michael Mallinson accompliced with working group (1994), The Mallinson Report**

**Newell, G. and Kishore, R. (1998), “The accuracy of commercial property valuations”, 4<sup>th</sup> Pacific Rim Real Estate Society Conference, Perth**

**Parker, D. (1998), “Valuation accuracy – an Australian perspective”, 4<sup>th</sup> Pacific Rim Real Estate Society Conference, Perth**

**Trott, A. (1980) Property Valuation Methods: Interim Report, Polytechnic of the South Bank / RICS London**

**Webb, R.B. (1994), “On the reliability of commercial appraisals: an analysis of properties sold from the Russell-NCREIF index”, *Real Estate Finance*, 11:1, 62-5**