Valuation accuracy: reconciling the timing of the valuation and sale

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Abstract

Carsberg (2002) suggested that the periodic valuation accuracy studies undertaken by, amongst others, IPD/Drivers Jonas (2003) should be undertaken every year and be sponsored by the RICS, which acts as the self-regulating body for valuations in the UK. This paper does not address the wider issues concerning the nature of properties which are sold and whether the sale prices are influenced by prior valuations, but considers solely the technical issues concerning the timing of the valuation and sales data.

This study uses valuations and sales data from the *Investment Property Databank* UK Monthly Index to attempt to identify the date that sale data is divulged to valuers. This information will inform accuracy studies that use a cut-off date as to the closeness of valuations to sales completion date as a yardstick for excluding data from the analysis. It will also, assuming valuers are informed quickly of any agreed sales, help to determine the actual sale agreed date rather than the completion date, which includes a period of due diligence between when the sale is agreed and its completion. Valuations should be updated to this date, rather than the formal completion date, if a reliable measure of valuation accuracy is to be determined.

An accuracy study is then undertaken using a variety of updating periods and the differences between the results are examined. The paper concludes that the sale only becomes known to valuers in the month prior to the sale taking place and that this assumes either that sales due diligence procedures are shortening or valuers are not told quickly of agreed sale prices. Studies that adopt a four-month cut-off date for any valuations compared to sales completion dates are over cautious, and this could be reduced to two months without compromising the data.

1.   Introduction

Crosby and Matysiak (2002) developed the valuation accuracy debate and focussed on the issues which they consider essential to developing a meaningful approach to assessing the relationship between valuations and prices.   Annual, quarterly and monthly valuations are used in the UK as the major basis of commercial property performance measures and are therefore subject to considerable debate.

During 2001, the Royal Institution of Chartered Surveyors asked Sir Bryan Carsberg, former director of the Office of Fair Trading in the UK, to chair a real estate valuation industry committee addressing certain aspects of the appraisal process. The committee was set up in response to a report by the Universities of Reading and Nottingham Trent (Baum, *et al* 2000), and Carsberg reported in early 2002 with 18 recommendations (Carsberg, 2002).   Two of these recommendations referred to the monitoring of the outcome of the valuation process in the UK, making reference to previous work on valuation accuracy, particularly the periodic scrutiny of sales and previous valuations in the Investment Property Databank (see IPD/DJ, 2003 for the latest in a line of seven reports from 1988 onwards).

The relevant recommendations were:

1.   "*The RICS should enter discussions with Investment Property Databank with a view to agreeing a means by which their data could be used to produce ongoing annual reports on the correlations between valuations and achieved prices as observed by IPD, and consider with the wider academic community how the data can be additionally analysed to provide better information on the currency of valuations. The RICS should also encourage research into the valuation process and behavioural issues and ensure that the knowledge gained is fully integrated into the educational system.*

2   *The RICS should approach IPD to identify what further information about the composition and performance of valuers contributing to its Indices could be published.*

The RICS Carsberg Review committee was set up to implement these recommendations and reported in late 2002.   In relation to the two recommendations above concerning valuation accuracy and variation, it reported:

> *RICS has agreed a process with IPD which will give effect to Carsberg recommendations one and two. This will take effect from IPD's annual report in 2003.*
>
> RICS (2002)

The first RICS/IPD report on valuation accuracy will build off the existing IPD/DJ series of valuation accuracy reports and the first one is due in 2003.   However, in consultation with a steering group comprising of academics from the University of Reading and City University, the approach to the accuracy study is being changed and developed and this paper sets out part of that development.   Some of this development will appear in the 2003 RICS/IPD study but subsequent studies will further develop the approach.

This paper addresses issues attached to timing and updating of valuation to sale date.   The first issue concerns the updating of valuation to the sale date.   The question being addressed is: what updating mechanism and length of time should be used to change the valuation to what it would have been had it taken place at the same time as the sale?   This time is normally

taken to be the sale completion date, but the actual date the sale price is agreed/set will be earlier, allowing time for due diligence and legal procedures to take place.

The second issue relates to the contamination of the valuation by knowledge of the sale price, at a date prior to the sale completion date. The two issues are connected as the sale price will be known in advance of the completion date and may be passed onto the valuer doing a performance measurement valuation after the sale is agreed but before it is completed. In addition to knowing how long the period is between sale price agreement and completion date, it is also necessary to find out whether valuers appear to know about the agreed sale price or if are they kept unaware by owners and fund managers.

Some of these questions could be answered by survey work of valuers and owner/managers, but the results reported in this paper are based on a preliminary analysis of valuations and sale prices in the Investment Property Databank UK Monthly Index. It attempts to identify the date that sale data is divulged to valuers by examining valuation movements in the months leading up to completion. This information will inform accuracy studies that use a cut-off date concerning the closeness of valuations to sales completion date as a yardstick for excluding data from the analysis. It will also, assuming valuers are informed quickly of any agreed sales, help the determination of the actual sale agreed date rather than the completion date, which includes an element of due diligence between when the sale is agreed and its completion. Valuations should be updated to this date, rather than the formal completion date, if a reliable measure of valuation accuracy is to be determined.

2.   Literature review

The Market Valuation definition is:

Market Value is the estimated amount for which a property should exchange on the date of valuation between a willing buyer and a willing seller in an arm's-length transaction after proper marketing wherein the parties had acted knowledgeably, prudently, and without compulsion. (IVSC, 2001).

The *accuracy* of any valuation is, therefore, defined as how close the valuation is to the exchange price in the market place. Studies of valuation accuracy have therefore consisted of measuring the relationship between valuations and subsequent sale prices of individual properties.

The last in the series of seven IPD/Drivers Jonas "Variance in Valuations" studies between 1988 and 2002 was published in May (IPD/DJ, 2003). It is in fact an *accuracy* study within the definitions given above, as it compares valuations with sale prices. The study has 19 years of data from 1983 to 2001 with around 13,000 commercial property sales matched with previous valuations. The average number of transactions for each year is close to 700 and over the last five years, the number is just over 1,000 for each year (IPD/DJ, 2003).

This work is aimed at a practitioner audience but has been criticised by academic commentators for the lack of explicit technical information concerning the basis of the study and the detail of the output of the statistical analysis (Matysiak and Wang, 1995). These criticisms are not only made of the IPD/Drivers Jonas studies but have also been made of other accuracy studies.

Matysiak and Wang (1995) and Blundell and Ward (1997) are the two other major accuracy studies in the UK. Both use data from the Jones Lang LaSalle Property Performance Analysis System (PPAS). Blundell and Ward used 747 transactions between 1973 and 1990 and Matysiak and Wang (1995) used a smaller sub-set of 317 transactions from the same dataset from 1973 to 1991.

In the US, there have also been a number of studies; for example, Cole *et al* (1986), Webb (1994) and Fisher *et al* (1999). Newell and Kishore (1998) and Parker (1998) have also carried out accuracy studies in Australia.

Crosby and Matysiak (2002) examined these studies and raised a number of issues which can be isolated from the review. These were the independence of sale price and valuation, the nature of individual sale price and valuation, selection bias, the timing of sale price and valuation, market state, the lagging of valuations, the segmentation of data, liquidity of markets and the statistical methods of analysis and reporting. This paper concentrates on the timing issue and approaches to data transformation.

Accuracy studies have to address the issue that a sale takes time to transact and the sale price is known at a point in time before the actual transaction date. On this aspect, Crosby and Matysiak (2002) isolated a number of issues. The first is the number of valuations excluded from the analysis as being possibly contaminated by knowledge of the sale price, the second is the data used to update the valuation to the sale date and the third is the time scale of this transformation.

The whole problem is tied to the property sale process. This process requires a number of legal formalities to be completed, so the actual sale price may be decided some time in advance of the completion date. In the UK, a contract date usually precedes the completion date. In addition to the legal processes, confirming title and other matters, between sale price agreement date and contract date. In 1995, the Investment Property Forum carried out a study of the sale process in an attempt to identify where it could be made more efficient and shorter, increasing the liquidity of the UK commercial property market. The report made a number of recommendations concerning the whole transaction process including the period between the provisional agreement of price and completion. They suggested significant steps could be taken to reduce transaction time with sellers being much more organised in terms of availability of documentation and more standardisation of legal documents (IPF, 1995).

In 1996, the IPF followed this up with a guidance note concerning transactions, to facilitate and speed up the process. They suggested formats for the contents of a complete property information package at the outset of the transaction and detailed the information to be included (IPF, 1996). But neither of these reports gave any indication of how long this process normally took in the UK investment market.

Two years later, McNamara (1998) surveyed 31 property professionals working for property consultants or owners. They suggested that due diligence plus settlement time ranged from 5 weeks for high street retail units and retail warehouses, through 7-9 weeks for offices and business parks to 13 weeks for major shopping centres. Total time to completion including the marketing period to find a buyer ranged from 9.7 weeks for a large town retail unit to 21.6 weeks for the major in-town shopping centre. This suggests that a sale price will be fixed at least one month and up to 3 months before the official completion date. The period of the adjustment therefore needs amending from the date of completion of the sale to a date sometime before the completion date. The literature suggests somewhere between one and three months and that this varies for each segment of the market.

This information impacts on the other adjustment that accuracy studies have to make regarding which of any previous valuations are not affected by prior knowledge of the sale price. Fisher *et al* (1999), using quarterly valuation data, assumed at least two quarters differential. Blundell and Ward (1997), also using quarterly data, went to the penultimate valuation before the sale. Their minimum was therefore just over 3 months. The average gap was around 4.5 months. The IPD/Drivers Jonas studies used annual data and the average gap

between valuations and prices was over 9 months (see, for example, IPD/Drivers Jonas, 1990) based on the control that no valuation closer than 4 months to the sale price was used.

Having identified the period of adjustment, the final issue relates to the approach to adjusting for any value changes in that period. IPD/Drivers Jonas measured the absolute differences between valuation and sale price, but then attempted to isolate systematic and random errors. Systematic errors will pick up the average difference between the valuations and prices and therefore takes account of the average change in the sold properties. Blundell and Ward (1997) also used the data untransformed but test for market change within their statistical analysis. Matysiak and Wang (1995) explicitly updated valuations and used the IPD capital growth rather than the capital growth from the PPAS as they argued that the PPAS system valuations were under scrutiny. They argued that since any capital growth index is purely a function of the change in valuations, updating the valuations using the capital growth index introduces an element of "self-referencing" (Matysiak and Wang, 1995).

Cole, Guikey and Miles (1986) used the consumer price index assuming that a sale took place in mid-quarter. This assumes property markets and inflation move in tandem. Fisher, *et al* (1999) used the capital gain component of NACREIF database, the same database that they were using for the analysis, adopting the capital gain from the "appropriate property type and geographic division" of the data.

The various methods adopted raise a number of questions concerning analysis for the time differential. Using valuations close to the sale date increases the risk of prior knowledge. However, increasing the time differential between valuation and sale date increases any error due to the change in the actual property value being different to the index value. The McNamara survey results suggest that the UK studies reported above have taken proper precautions to eliminate any valuations which might have been contaminated by prior knowledge and, if anything, suggests that they have been overcautious. Without researching the institutional context in the US, which we have not done for this paper, the only comment about the Fisher study is that in the UK context it also looks overcautious.

Regarding the index used to update, although Matysiak and Wang (1995) question the validity of adjusting by a capital growth index partly based upon the same properties which are being analysed, there is bgic to the Fisher, *et al* (1999) approach. The objective is to place the valuation on the same time frame as the sale and so using the changes in valuations from the same data set gives some indication of what the valuation would have changed to without any prior knowledge. On balance, this is the preferred approach.

The final question raised by the timing issue concerns changes to the property in the intervening time between valuation and sale, for example, capital expenditure. Where this was the case, Fisher *et al* (1999) took expenditure into account in the valuation. This raises questions of whether cost equals value and Mokrane (2002) inserts capital expenditure into a regression equation as a percentage of the valuation in an attempt to identify its effect on value. A major question centres on the type of expenditure and its effect on value and price. Excluding properties with expenditure in this period is a safer option.

The research questions addressed by this paper are therefore:

- Is there any evidence that the valuations show increased movements to the sale price in a particular month before the sale completion date indicating prior knowledge of the price?

- Does updating valuations to dates other than the completion date impact on the accuracy of valuations?

This paper addresses the timing issue in two ways.

Firstly, for 2002 transactions involving properties in the monthly index, the sequence of valuations up to the point of sale were examined. Of interest is whether there is a particular point at which valuations converge towards the sale price more than would otherwise be expected given market movements. We report the all property results and disaggregation by main sector: retail, office and industrial.

Secondly, for each transaction, the first valuation outside a four-month window back from the completion date was identified and this was then updated to a number of different points. The points were three months, two months and one month before sale, and the sale completion month itself. At each point, the difference between the updated valuations and the sale prices were calculated. The distributions of these differences were then compared to see how the point of updating affects the conclusions made about valuer accuracy. Finally this exercise was repeated using the first valuation outside a two-month window, which were then updated to two months and one month before completion and to the actual completion date and the results of the analyses compared to see if any significant differences in accuracy emerged.

3.   Data transformation and analysis

The data used in this analysis of valuation accuracy are individual transaction records for properties in the IPD UK Monthly Index for properties sold in 2002. These records include information on the sale price and completion date, the type and location of each property, and the previous valuations for those properties. The price agreement date in each case is unknown and this affects the approach to updating valuations described below. All the handling and processing of individual property data was done by IPD to maintain investor confidentiality.

Sales transactions for 2002 were identified from the monthly databank. Not all of these transactions were suitable for analysis. For instance, some of the transactions were not individual sales, but part of portfolio deals. In these cases, the sale price may not reflect OMV, but contain either a discount or premium to OMV from being part of a bulk purchase. Properties in sectors such as hotels and agricultural land were also excluded. These do not form a significant part of institutional portfolios and so only a small number of these deals are captured in the IPD database. This still leaves 417 transactions on which analysis can be undertaken, 241 retail, 111 offices and 65 industrial.

For part of the analysis, valuations needed updating for time. In these cases, the average capital growth for the property's type and location were used. The segments used for this purpose were as follows:

> Standard Retail South East, Standard Retail Rest of UK, Shopping Centres
> (Malls), Retail Warehouses, City of London Offices, Midtown / West End
> London Offices, Rest of South East Offices, Rest of UK Offices, South
> East Industrials, Rest of UK Industrials.

The market in 2001 and 2002 was fairly static, with the all property capital growth index falling by 0.5% in 2001 and increasing by 2.5% in 2002. Retail fell by 1.3% in 2001 but recovered by around 6.5% in 2002. Offices increased by 0.5% in 2001 but fell in 2002 by over 2%. Industrials were virtually static in 2001 and increased slightly, but by less than 2% in 2002 (IPD, 2003).

The first question is whether there is any evidence that the valuations show increased movements to the sale price in a particular month before the sale completion date, which may

indicate prior knowledge of the price. Table 1 and Figure 1 set out the average percentage difference between sale price and monthly valuations undertaken in the year before the sale, broken down by the three main sectors of retail, office and industrial.

Table 1: Difference between valuation and sale price IPD Monthly Index 2002 (V1 = valuation in month before sale, etc)

	Retail	Office	Industrial	All Property
V1	2.4%	3.8%	5.7%	3.3%
V2	4.9%	5.9%	6.8%	5.4%
V3	5.7%	6.4%	7.0%	6.1%
V4	6.4%	5.7%	7.8%	6.5%
V5	6.8%	6.1%	7.8%	6.8%
V6	6.4%	6.0%	8.0%	6.6%
V7	6.5%	6.3%	8.3%	6.7%
V8	6.4%	6.3%	8.5%	6.7%
V9	5.8%	6.2%	8.2%	6.3%
V10	5.9%	6.5%	8.1%	6.4%
V11	5.5%	6.6%	8.0%	6.2%
V12	5.5%	6.7%	8.1%	6.2%

Overall, the last valuation is on average 3.3% below the sale price. The previous month's valuation is on average 5.44% below the sale price and the monthly valuation before that is 6.08% below sale price. The previous 9 average differences between valuations and sale prices are then all within a range of 6.21% to 6.77%. This suggests that movement towards the sale price takes place no more than two valuations before the sale and that the major change is in the last valuation before the sale. This may indicate that prior knowledge of agreed sale prices is not in the valuer's domain until, at most, two months before completion date.

Table 2 and Figure 2 illustrate the shape of this movement more clearly by examining the average change in the valuations from month to month and then the remaining difference between the sale price and the last valuation.

Table 2: Average differences between monthly valuations from period to period and between the final valuation and the sale price for each transaction - IPD Monthly Index 2002 (P = sale price, V1 = valuation in month prior to sale price, etc)

|	Retail	Office	Industrial	All Property
P from V1	2.9%	6.0%	7.2%	4.4%
V1 from V2	3.5%	2.5%	1.2%	2.9%
V2 from V3	1.0%	0.7%	0.3%	0.8%
V3 from V4	0.9%	1.5%	1.0%	1.1%
V4 from V5	0.6%	0.5%	0.0%	0.5%
V5 from V6	-0.2%	0.0%	0.3%	-0.1%
V6 from V7	0.1%	0.4%	0.5%	0.3%
V7 from V8	-0.1%	0.0%	0.3%	0.0%
V8 from V9	-0.4%	0.0%	-0.1%	-0.2%
V9 from V10	0.1%	0.3%	0.7%	0.2%
V10 from V11	-0.3%	0.3%	0.2%	0.0%
V11 from V12	0.1%	1.2%	0.2%	0.4%

Note: P = sale price, V1 = last valuation before sale price in month prior to completion of sale price, V2 = penultimate valuation prior to sale, etc up to V12 = valuation carried out approximately a year before sale.

The average change is rarely more than 1% until the last valuation before sale, where it moves significantly. This movement is most pronounced in the retail and office markets. There is also a significant difference between the last valuation and the actual sale price. Both of these figures are larger than the differences between the previous 10 valuation periods[1].

The last valuation could not be done more than 1 month from the completion date. It would be expected that the valuation done closest to the sale date would be the most accurate due to market change, but that this movement towards the sale price would not accelerate in the last month.

Tables 1 and 2 in the Appendix set out the fuller results of the analysis of the monthly valuations.

Figure 1: Differences Between Sale Price and Previous Valuations – IPD Monthly Index 2002

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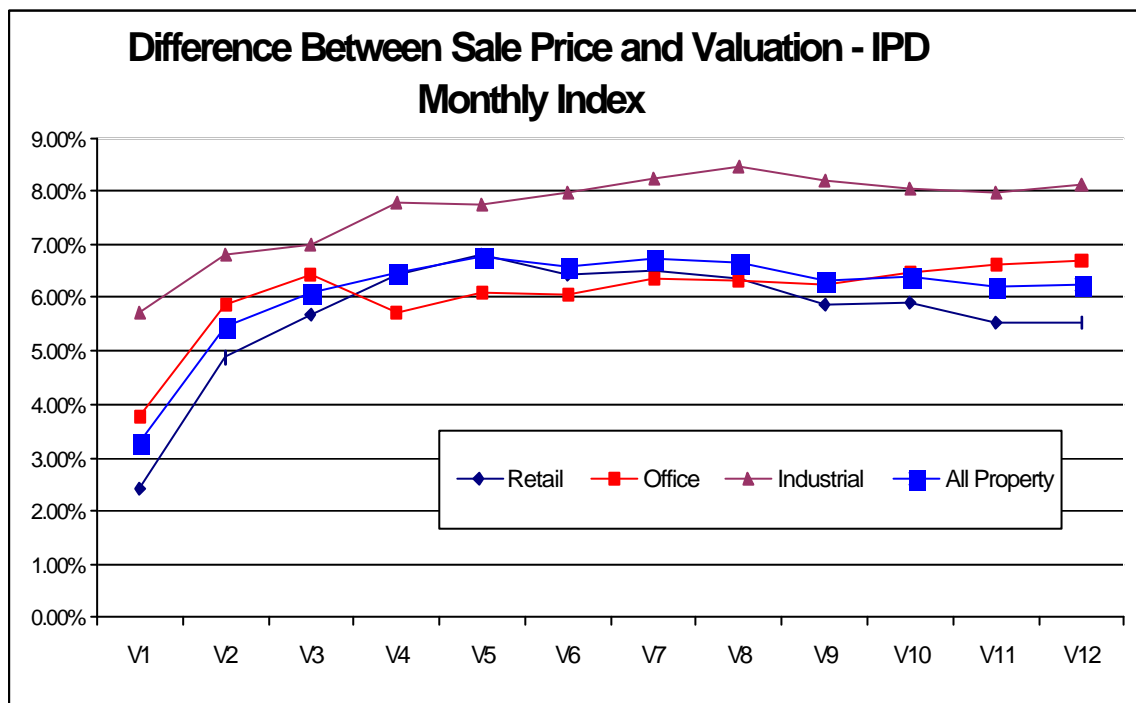
[1] T tests set out in appendix Table 3 show that the change in the last month's valuation over the previous valuation and the *difference* in the sale price from the last month's valuation are statistically significant.

Figure 2: Average Changes in Valuations in Year Prior to 2002 Sale of Properties from Monthly IPD Index
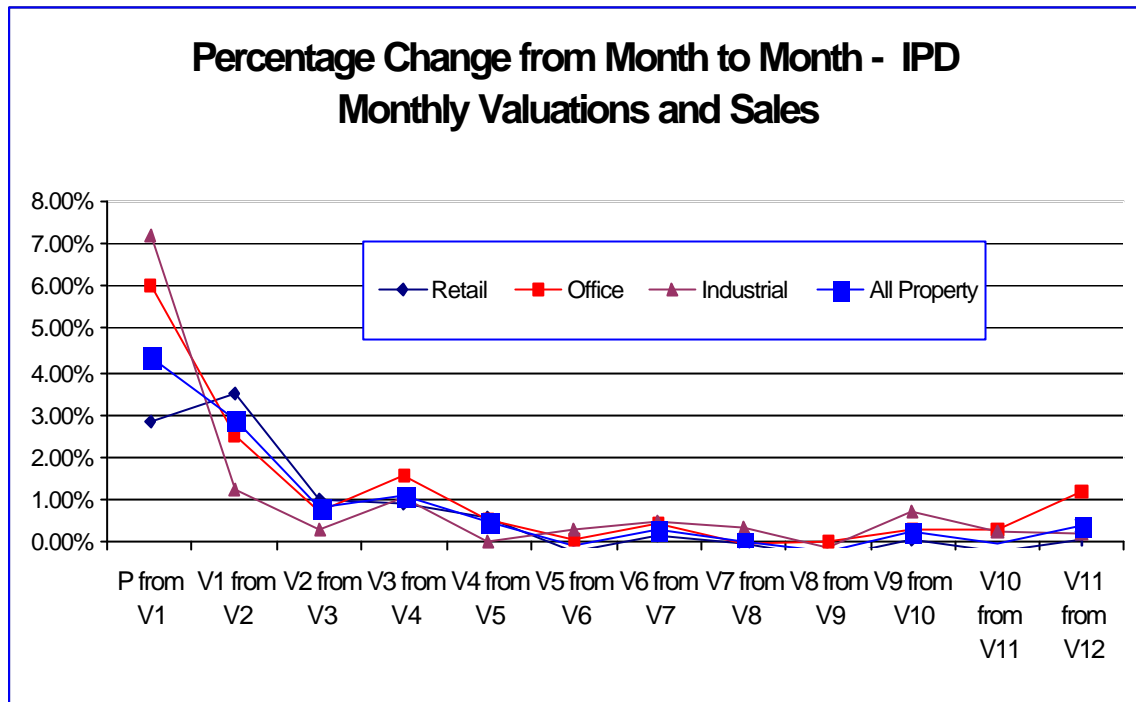
The conclusion from this first analysis is that valuers, for whatever reason, appear to be unaware of the agreed sale price until, at best, the last valuation before the sale. This valuation takes place in the last month before the sale so taking valuations within two months of the sale price would not compromise an accuracy study. So far, the major studies in the UK have taken a minimum of three months and in the case of the IPD study this creates an average lag of nine months between the valuation and the sale price, with some annual valuations being up to 15 months behind the sale.

Some questions regarding the transaction process still remain. Are the monthly properties in any way different to those held in the quarterly and annually valued portfolios (more liquid assets sought for the unit trusts, for example)? Does this mean that due diligence periods have shortened in the UK or are the valuers not being informed at draft valuation meetings (Baum, et al, 2000) concerning the provisional sale prices until all due diligence has been completed?

These points are also important for the second research question that relates to the updating period for the gap between valuation and sale price. The accuracy studies which have updated have always updated right up to completion date even though due diligence means that the price was negotiated earlier. The monthly valuation data analysed above suggests that the agreement date is closer to the completion date than does the McNamara study. As yet we have not undertaken our own study of the transaction process and so cannot conclude on whether the gap has shortened or the information flows are slow to reach the valuers. But the two strands of evidence suggest that the price is agreed somewhere between a few weeks and three months before the completion date. We have therefore tested the valuation accuracy figures to four dates: the completion date, 1 month before completion, two months before completion and three months before completion (termed 3 month boundary in Table 3).

Two analyses have been undertaken; assuming the criteria used in many previous accuracy studies that that no valuation of closer than four months to the sale price can be used and the new criteria that a valuation up to two months before the sale completion date can be used. Table 3 summarises the results and the full results are set out in the appendix Table 4.

Table 3: Average difference between valuation and sale price - IPD Monthly Index sales in 2002

Assumption 1: Vals are 4 months or older				
	Retail	*Office*	*Industrial*	*All Property*
3 month boundary	6.1%	5.8%	7.6%	6.2%
2 month boundary	5.7%	5.9%	7.5%	6.0%
1 month boundary	5.2%	6.1%	7.3%	5.8%
No boundary	4.7%	6.2%	7.1%	5.5%
Assumption 2: Vals are 2 months or older				
	Retail	*Office*	*Industrial*	*All Property*
3 month boundary	n/a	n/a	n/a	n/a
2 month boundary	4.9%	5.9%	6.8%	5.4%
1 month boundary	4.4%	6.0%	6.6%	5.2%
No boundary	3.9%	6.2%	6.4%	4.9%

Using valuations no nearer than four months before the sale price and updating to the completion date (no boundary) suggests that valuations lagged sale prices by 5.5% in 2002. If the sale prices were actually agreed before completion updating to completion understates valuation error in a rising market such as the retail and industrial markets in 2002 and overstates it in a falling market, as in the office market which fell in 2002. As the boundary increases (valuations are updated for a shorter time) the lagging increases from averages of 4.7% and 7.1% in retail and industrial to 6.1% and 7.6% respectively, while in the office market it falls from 6.2% to 5.8% assuming the boundary increases from zero to 3 months.

However, using newer valuations by reducing the cut off date to two months increases the accuracy by an average 0.6%, 0.8% in the retail market, 0.7% in the industrial market but only by 0.1% in the falling office market.

The evidence suggests an updating regime of up to two months before the completion date and also using valuations up to two months before the completion date. Under this scenario, the 2002 Monthly Index valuation accuracy results do not seem to improve significantly, improving from 5.5% to 5.4%, with retail showing decreased accuracy while offices and industrials indicate a small improvement. A cancelling out process has taken place.

The actual outcomes of the alternative updating date is a function of whether the market is static, rising or falling, and whether the valuations are higher or lower than the sale prices. The effect of decreasing the cut off date for "contaminated" valuations increase accuracy if, and only if, the later valuations are closer to sale prices than previous valuations with updating. As any updating strategy cannot entirely mimic the actual change in the valuation of the individual properties, it is possible that where prices are systematically above or below valuations, valuations updated over a longer period could end up closer to sale price than those updated over a shorter period. The updating index could over or under state the actual change in the value of each individual property asset so the outcome is not certain in terms of increasing accuracy.

Table 4: Taxonomy of Change in Accuracy

		Vals > Prices	Vals < Prices
Rising	*Reduce updating period*	Increase accuracy	Decrease accuracy
Market	*Adopt 2 month cut off period*	Random change	Random change
Falling	*Reduce updating period*	Decrease accuracy	Increase accuracy
Market	*Adopt 2 month cut off period*	Random change	Random change

Conclusions

This paper is part of a major professional and academic development in the UK, in the wake of a major review of the valuation process (Carsberg, 2002), to identify the accuracy of valuations more closely and publish the results annually for the practitioner market. Timing issues have been identified as one of the technical difficulties in producing definitive results on differences between prices and valuations. Previous studies have not had a consistent approach to the problem, some have virtually ignored it, others have taken it into account but no consensus as to the issues or the approach have emerged.

The two specific issues addressed by this paper are, first, whether the sale price is known before the completion date and that information is included in the valuation when the valuer is undertaking valuations close to that sale date and second, if the sale is agreed before completion date, should the valuation be updated to this date rather than to the completion date. Rather than carry out survey work, the approach taken by this paper is to try and identify whether the 2002 sales in the IPD Monthly Index throw any light on either or both questions.

The first analysis was to see if there is any evidence that the valuations show increased movements to the sale price in a particular month before the sale completion date, indicating prior knowledge of the price.

This analysis showed that a significant movement in the valuations took place in the month before the transaction was completed, but no earlier. However, the last valuation was still some distance from the sale price so either not all valuers have the knowledge of sale price when undertaking this valuation, or they are using a partial updating strategy. There is a strong indication that the use of no valuations within three or four months, the test imposed by previous studies, is too onerous and can be relaxed. We intend to test this further by analysing more years on the monthly index, (especially more volatile years), and by undertaking survey and case study work together with an analysis of the IPD UK annual index. However, there is a clear indication that previous studies have been over-cautious in this respect.

The second analysis was to compare the difference between valuations and sale prices for various updating periods: to completion date, 1 month before, 2 months before and 3 months before. Part of the analysis included only valuations undertaken over 4 months before the sale completion date, and the other part included all valuations up to 2 months before.

Updating to a date prior to the completion date decreases the level of accuracy in a rising market and increases it in a falling market, assuming average valuations are lower than average sale prices, which is the case in the 2002 data. However, using valuations closer to the sale completion date increased accuracy so, overall, by using more valuations closer to the date and only updating to the assumed sale agreed date little difference was made to the overall outcome.

The conclusion needs further testing but the analysis undertaken of the 2002 IPD Monthly Index, and the literature on the valuation process, suggest that the alternative updating policy outlined above and the use of valuations closer to the completion date should form the basis

for any accuracy study and will enable the determination of a more rational accuracy indicator.

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Appendix Table 1 : Difference between monthly valuation in year before sale (tminus1, 2, etc) and sale price (P) IPD Monthly Index 2002

Retail	P - tminus1	P - tminus2	P - tminus3	P - tminus4	P - tminus5	P - tminus6	P - tminus7	P - tminus8	P - tminus9	P - tminus10	P - tminus11	P - tminus12
Obs	241	241	241	241	241	241	241	241	239	239	238	236
Mean	2.43%	4.88%	5.68%	6.44%	6.82%	6.44%	6.50%	6.35%	5.84%	5.88%	5.53%	5.53%
St Dev	5.74%	8.52%	9.04%	9.34%	9.80%	11.03%	11.37%	11.86%	13.80%	13.84%	14.18%	14.18%

Office	P - tminus1	P - tminus2	P - tminus3	P - tminus4	P - tminus5	P - tminus6	P - tminus7	P - tminus8	P - tminus9	P - tminus10	P - tminus11	P - tminus12
Obs	111	111	111	111	111	111	111	111	111	111	111	111
Mean	3.77%	5.87%	6.43%	5.72%	6.08%	6.04%	6.34%	6.30%	6.23%	6.47%	6.63%	6.71%
St Dev	10.33%	11.29%	11.70%	22.50%	22.75%	22.99%	23.21%	23.26%	23.48%	23.57%	23.86%	23.94%

Industrial	P - tminus1	P - tminus2	P - tminus3	P - tminus4	P - tminus5	P - tminus6	P - tminus7	P - tminus8	P - tminus9	P - tminus10	P - tminus11	P - tminus12
Obs	65	65	65	65	65	65	65	65	65	65	64	63
Mean	5.70%	6.80%	6.99%	7.78%	7.76%	7.97%	8.26%	8.46%	8.22%	8.07%	7.98%	8.11%
St Dev	9.30%	9.24%	9.75%	10.48%	10.70%	11.00%	11.65%	12.04%	11.99%	13.50%	13.61%	14.06%

All	P - tminus1	P - tminus2	P - tminus3	P - tminus4	P - tminus5	P - tminus6	P - tminus7	P - tminus8	P - tminus9	P - tminus10	P - tminus11	P - tminus12
Obs	417	417	417	417	417	417	417	417	415	415	413	410
Mean	3.30%	5.44%	6.08%	6.46%	6.77%	6.57%	6.73%	6.67%	6.32%	6.38%	6.21%	6.24%
St Dev	7.87%	9.45%	9.91%	14.19%	14.50%	15.13%	15.44%	15.72%	16.70%	16.93%	17.23%	17.34%

Appendix Table 2 : Difference between sale price or valuation and preceding valuation IPD Monthly Index 2002
(P = sale price, V1 = valuation in month prior to sale price, etc)

Retail	GSP less tminus1	tminus1 less tminus2	tminus2 less tminus3	tminus3 less tminus4	tminus4 less tminus5	tminus5 less tminus6	tminus6 less tminus7	tminus7 less tminus8	tminus8 less tminus9	tminus9 less tminus10	tminus10 less tminus11	tminus11 less tminus12
Obs	241	241	241	241	241	241	241	241	239	239	238	236
Mean	2.85%	3.50%	0.99%	0.90%	0.55%	-0.24%	0.13%	-0.07%	-0.39%	0.06%	-0.25%	0.05%
St Dev	6.31%	14.68%	4.35%	3.39%	2.88%	3.15%	2.11%	2.53%	2.63%	1.37%	2.50%	1.75%

Office	GSP less tminus1	tminus1 less tminus2	tminus2 less tminus3	tminus3 less tminus4	tminus4 less tminus5	tminus5 less tminus6	tminus6 less tminus7	tminus7 less tminus8	tminus8 less tminus9	tminus9 less tminus10	tminus10 less tminus11	tminus11 less tminus12
Obs	111	111	111	111	111	111	111	111	111	111	111	111
Mean	6.02%	2.51%	0.70%	1.54%	0.50%	0.04%	0.42%	-0.03%	0.00%	0.30%	0.30%	1.19%
St Dev	22.65%	5.63%	2.68%	18.88%	2.99%	2.51%	2.42%	0.88%	2.15%	1.51%	3.10%	18.91%

Industrial	GSP less tminus1	tminus1 less tminus2	tminus2 less tminus3	tminus3 less tminus4	tminus4 less tminus5	tminus5 less tminus6	tminus6 less tminus7	tminus7 less tminus8	tminus8 less tminus9	tminus9 less tminus10	tminus10 less tminus11	tminus11 less tminus12
Obs	65	65	65	65	65	65	65	65	65	65	64	63
Mean	7.22%	1.22%	0.29%	1.03%	0.02%	0.28%	0.47%	0.33%	-0.14%	0.71%	0.23%	0.19%
St Dev	12.15%	3.09%	2.51%	4.10%	0.96%	1.86%	2.93%	1.95%	3.99%	9.23%	1.39%	1.93%

All	GSP less tminus1	tminus1 less tminus2	tminus2 less tminus3	tminus3 less tminus4	tminus4 less tminus5	tminus5 less tminus6	tminus6 less tminus7	tminus7 less tminus8	tminus8 less tminus9	tminus9 less tminus10	tminus10 less tminus11	tminus11 less tminus12
Obs	417	417	417	417	417	417	417	417	415	415	413	410
Mean	4.38%	2.88%	0.80%	1.09%	0.45%	-0.08%	0.26%	0.00%	-0.25%	0.22%	-0.03%	0.38%
St Dev	13.59%	11.61%	3.72%	10.18%	2.71%	2.82%	2.33%	2.12%	2.78%	3.86%	2.56%	9.94%

Appendix Table 3 : Significance testing of changes in last valuation and sale price

Significance testing of the proportional changes - last valuation changer from penultimate valuation is different from all other monthly valuation changes

All Property		Retail		Office		Industrial	
Sum of all changes	11.8933	Sum Retail changes	4.1549	Sum Offices changes	5.5272	Sum Industrial changes	2.2113
No of observations	4155	No of observations	2398	No of observations	1110	No of observations	647
Mean Change	0.29%	Mean Ret change	0.17%	Mean Off change	0.50%	Mean Ind change	0.34%

All Property		Retail		Office		Industrial	
Sample mean	2.88%	Sample mean	3.50%	Sample mean	2.51%	Sample mean	1.22%
Hypothesised mean	0.29%	Hypothesised mean	0.17%	Hypothesised mean	0.50%	Hypothesised mean	0.34%
Sample StDev	11.61%	Sample StDev	14.68%	Sample StDev	5.63%	Sample StDev	3.09%
No of obs in period	417	No of obs in period	241	No of obs in period	111	No of obs in period	65
T Statistic	4.5699	T Statistic	3.5235	T Statistic	3.7688	T Statistic	2.3006
P-values	0.0000	P-values	0.0003	P-values	0.0001	P-values	0.0123

Significance testing of the proportional changes - difference between last valuation and sale price compared to monthly changes in valuation

All Property		Retail		Office		Industrial	
Sum of all changes*	23.9222	Sum Retail changes	12.6003	Sum Offices changes	8.3160	Sum Industrial changes	3.0060
No of observations	4572	No of observations	2639	No of observations	1221	No of observations	712
Mean Change	0.52%	Mean Ret change	0.48%	Mean Off change	0.68%	Mean Ind change	0.42%

* This time including the last valuation change

All Property		Retail		Office		Industrial	
Sample mean	4.38%	Sample mean	2.85%	Sample mean	6.02%	Sample mean	7.22%
Hypothesised mean	0.52%	Hypothesised mean	0.48%	Hypothesised mean	0.68%	Hypothesised mean	0.42%
Sample StDev	11.61%	Sample StDev	14.68%	Sample StDev	5.63%	Sample StDev	3.09%
No of obs in period	417	No of obs in period	241	No of obs in period	111	No of obs in period	65
T Statistic	6.7783	T Statistic	2.5132	T Statistic	9.9920	T Statistic	17.75185
P-values	0.0000	P-values	0.0063	P-values	0.0000	P-values	0.0000

Appendix Table 4 : Difference between valuation and sale price IPD Monthly Index sales 2002

Assumption 1: Valuations used up to four months old

		3 month boundary	*2 month boundary*	*1 month boundary*	*No boundary*
Retail	*Mean diff*	6.1%	5.7%	5.2%	4.7%
	Median diff	4.5%	4.0%	3.7%	3.1%
	Skewness	1.707933	1.734517	1.743249	1.759004
Office	*Mean diff*	5.8%	5.9%	6.1%	6.2%
	Median diff	5.4%	5.1%	5.0%	5.1%
	Skewness	-5.24924	-5.27274	-5.28952	-5.29884
Industrial	*Mean diff*	7.6%	7.5%	7.3%	7.1%
	Median diff	5.0%	5.1%	4.9%	4.7%
	Skewness	0.682979	0.683113	0.678158	0.679843
All Property	*Mean diff*	6.2%	6.0%	5.8%	5.5%
	Median diff	4.7%	4.4%	4.0%	3.7%
	Skewness	-5.22983	-5.21346	-5.17158	-5.11124

Assumption 2: Valuations used up to two months old.

		3 month boundary	*2 month boundary*	*1 month boundary*	*No boundary*
Retail	*Mean diff*	n/a	4.9%	4.4%	3.9%
	Median diff	n/a	3.0%	2.5%	1.9%
	Skewness	n/a	2.267073	2.2865	2.312913
Office	*Mean diff*	n/a	5.9%	6.0%	6.2%
	Median diff	n/a	3.0%	3.4%	4.2%
	Skewness	n/a	1.547642	1.549148	1.546456
Industrial	*Mean diff*	n/a	6.8%	6.6%	6.4%
	Median diff	n/a	5.3%	5.3%	5.2%
	Skewness	n/a	0.868895	0.861808	0.863542
All Property	*Mean diff*	n/a	5.4%	5.2%	4.9%
	Median diff	n/a	3.2%	3.1%	2.9%
	Skewness	n/a	1.810292	1.828851	1.847033