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Property Valuation and Sensitivity Analysis – Does Increased Disclosure Decrease Uncertainty?

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Abstract. *It has been argued that one of the key reasons for the persistence of the net asset value (NAV) discount phenomenon is that investors do not trust the disclosed property values of listed real estate companies. The purpose of the study is to find out whether investors trust reported fair values of investment properties more when corporations support the provided valuations with a sensitivity analysis. A sample of 102 European publicly listed real estate companies is used to conduct the empirical study. The study is based on a regression model which analyses the relationships between the disclosed amount of investment properties and the market value of equity. Data on the amount of investment properties held by the sample companies is collected from annual reports from fiscal year 2012. The study utilizes disclosures mandated by International Financial Reporting Standard IAS 40 which requires companies to disclose the methodology used to value investment properties. Additional data needed for the regression model is collected from the Thomson Datastream and Thomson Worldscope databases. The paper, and the data set used, is largely based on previous work by Laakso (2016). Results of the empirical study support the research hypothesis, i.e. property values that are supported by sensitivity analyses are perceived by financial markets as more value relevant than properties for which no such analysis is provided.*

Keywords: *Investment property, fair value, REIT, NAV discount, sensitivity analysis, value relevance.*

1 Introduction

A significant problem for publicly listed real estate companies has been that their market values are often lower than the book values of their equity. The observation holds true also when properties are reported at fair value. This net asset value (NAV) discount has been persistent even though its size has fluctuated over time and varied between markets.

The NAV discount phenomenon is contradictory to intuition, as it could be expected that publicly traded indirect real estate assets would trade at a premium compared to similar direct real estate assets due to their commonly acknowledged

positive characteristics (e.g. better price formation and smaller lot size) (Bendetto & Morri, 2009). Even though previous research has tried to explain the discounts no consensus has yet been reached. Some argue that NAV discounts are caused by the low level of trust that investors place in reported property values (e.g. Baum et al. 2003), the costs caused by the management of property companies (e.g. Ingersoll, 1976) and by agent-principal problems such as moral hazard and adverse selection (e.g. Adams & Venmore-Rowland, 1989).

The goal of this paper is to shed more light on one of the factors affecting the NAV discount. The paper is based on the same data and literature as a previous paper by Laakso (2006). The approach chosen to study factors impacting the NAV discount is based on the concept of *value relevance.* Various academics have tried to define the term *value relevance* in different ways (e.g. Barth et al. 2001; Fen et al. 2010; Brown et al. 1999) but the central idea for all of these definitions is that a reported balance sheet item is deemed to be value relevant if it has a statistically significant association with the market value of equity.

The paper tries to identify whether the value relevance of investment property is different for companies that provide sensitivity analyses to support their property valuations compared to companies that do not disclose such information. The expectation is that, the disclosure of additional information on the sensitivity of property valuations decreases information asymmetries between the investors and management. Furthermore, these disclosures are assumed to increase trust in the reported property valuations and lead to higher value relevance for the assets in question. A multiple linear regression model will be constructed to test these assumptions.

The research contributes to the value relevance literature and to the debate about the reliability of fair value estimates for investment property. The study also provides light on the possible effects of different accounting approaches for investment properties and it can therefore help standard setters in their work. The results will also be of interest to the management of listed real estate companies as they will be able to understand better how to affect the NAV discount of their company. The interest in the results will be further strengthened due to the fact that the sample consists of large European real estate companies that are currently under a high level of public and regulatory scrutiny.

The remainder of the study is structured in the following way. Chapter 2 provides an overview of the problems that are inherent for property appraisal and fair value measurement. Chapter 3 describes previous research on the topic of the paper. This chapter also develops the research hypothesis that is tested in the empirical portion of the paper. Chapter 4 describes the sample selection process and the research methodology. Limitations of the research are also addressed. Chapter 5 presents the results of the empirical study, and Chapter 6 develops conclusions and discusses possibilities for future research.

2 Problems in Property Appraisal and the use of Fair Values

Valuing assets at fair value has always faced criticism. The relevance and reliability of these estimates are often questioned and the resulting valuations are said to be prone to biases which are strengthened when the assets in question lack transparent and efficient markets. Investment properties are a good example of such assets. The heterogeneity of real estate and the absence of liquidity make property markets more prone to valuation errors and biases than many other markets. Supporters of fair value estimates claim that fair values provide more informative, timely and transparent financial statement information to the investor community in comparison to any of the alternatives (Ryan, 2008). Research has shown that fair values are on average seen as more value relevant than historical costs (e.g. Carroll et al. 2003; Barth, 2006). Fair values also enable management to communicate private information to investors which increases the efficiency of financial markets (Beaver & Venkatachalam, 2003).

Opponents of the use of fair values usually concentrate on the measurement difficulties in illiquid markets and on the procyclicality of the valuation practice. Illiquidity is also a central characteristic of real estate and this argument is therefore highly relevant for the analysis of this paper. An additional argument against fair value measurement is the subjectivity required by the valuation models. This argument is also relevant for real estate assets as the valuation models of properties require the use of subjective inputs such as market yields, discount rates, expected vacancy rates, and rental levels. This subjectivity can lead to identical properties being valued differently by different companies, which creates apparent problems for the comparability of financial statement information.

Research suggests that fair value estimates are perceived as unreliable when management has strong incentives to misreport financial information (Danbolt & Rees, 2008). Such incentives can be induced when management compensation is tied to earnings goals that are otherwise hard to achieve, or when analysts provide optimistic forecasts that management does not want to miss in fear of market repercussions. Managers might also be willing to report biased estimates of fair values if the company is in financial difficulties and management wants to prolong the time that it takes for markets to discover these issues (Graham et al. 2006). Consequently, regulators need to consider how to let managers reveal private information through fair value estimates while at the same time minimizing possibilities for the manipulation of model inputs (Landsman, 2006).

The most common method for valuing commercial property relies on data from actual sales transactions of comparable properties. It has been argued that this reliance on historical data causes valuation to become a backward-looking process which results in smoothed property values that do not fully reflect all market information available at the time of the appraisal (Brown & Matysiak, 2000). Others have argued that this methodology which results in lagging and smoothed values is in fact the most optimal way of valuing real estate in thinly traded markets (Quan & Quigley, 1991).

Behavioral real estate research has also shed some light on the question of the reliability of real estate appraisal. Appraisers have been found to be prone to

anchoring, i.e. changes in values are under-estimated because the appraiser uses agreed sales prices or estimates of other appraisers as a reference point for the valuation process (Baum et al, 2003; Diaz, 1997). Appraisers can also be afraid of litigation and thus avoid proposing drastic changes to fair values in the absence of large amounts of transactional evidence. In the worst case, such behavior can force appraisers into not utilizing currently available information and relying on scarce and out of date historical transactions (Crosby et al. 1998). Such behavioral aspects contribute further into appraisal smoothing and under-estimation of the true variance of real estate values.

Some evidence also suggests that, companies purchasing appraisal services are able to influence the outcome of the appraisal process (Gallimore & Wolverton, 2000). Appraisers are obviously keen to maintain a good relationship with their clients which can threaten the independence of the appraiser. If a sharp decline in property values has negative effects on the compensation of client management, appraisers might take this into consideration when valuing the properties. Appraisers might not to report such declines in property values in fear of losing the client.

In addition to the previously described inherent problems of the property appraisal process, sometimes the appraisers simply do not have the necessary knowledge on how investment property should be valued according to IAS 40 (Huschke, 2007). The definition of fair value by IAS 40 is not always identical to the definitions of commonly applied property valuation frameworks. There are also significant differences between the methodological guidance offered by real estate sector institutions which leads to different valuation methodologies being applied in different European countries (Huschke, 2007; McParland et al. 2002). IVSC is the most prominent of the organizations promoting harmonization of appraisal techniques but there are also several other institutions which issue guidance on estimating fair values, e.g. The European Group of Valuators' Associations, The Royal Institute of Chartered Surveyors and the European Public Real Estate Association (Nelssen & Zuelch, 2011).

In conclusion, the fair values of investment properties are far from objective truths but rather a result of combining complex valuation methodologies with subjective estimates, lagging historical transaction prices and behavioral biases of human nature. It is therefore logical that financial markets do not take these valuations at face value but apply their own judgment in assessing the properties in question. This unavoidably leads to differences between the reported property values and the value estimates provided by the financial markets. Such differences are often reflected in the observed NAV discounts.

3 Literature Review and Hypothesis Development

3.1 Value Relevance of Fair Values

To the best of the author's knowledge, no studies have been conducted on the impact of sensitivity analyses on the relevance of property valuations. However, as the goal of disclosed sensitivity analyses is to decrease information asymmetry

between corporate insiders and investors, and to increase the trust placed on the reported property values, the research conducted under the broad umbrellas of value relevance and NAV discounts are closely connected to the topic of the paper. Relevant research in these two fields is therefore reviewed.

Empirical research has provided considerable evidence suggesting that fair values are value-relevant, i.e. they have a statistically significant association with the market value of equity (e.g. Kolev, 2008). The incremental value of additional disclosures to supplement balance sheet and income statement information has also been found to be positive both in archival and survey studies (Bischof, 2009). The sensitivity analyses for property values are considered such "additional disclosures" that supplement balance sheet information. Even though this kind of supplemental information is considered relevant in equity valuation, it is still less relevant than the information contained in the balance sheet and income statement (Ahmed et al. 2006).

Barth (1994) used a sample of US banks, and data from 1971–1990, to study how disclosed fair value estimates of investment securities are reflected in share prices in comparison with historical costs. The findings indicated that fair values of assets provide relevant information to investors in valuing equity. The results also showed that fair values exhibit more explanatory power than valuations based on historical costs.

Carroll et al. (2003) analyzed a sample of 143 closed-end mutual funds during 1982–1997 to examine the value relevance of the financial instruments held by these companies. The study found a significant association between stock prices and the fair value of investment securities. The authors also examined whether the perceived reliability of fair values differs between financial instruments. The results indicated that even securities traded on thin markets do not cause the incremental value-relevance of fair value information to disappear. This study is particularly relevant for the real estate market because property markets are a good example of thin markets due to their illiquidity.

Danbolt and Rees (2008) studied British real estate and investment fund industries in order to compare the value relevance of historical cost and fair value accounting. They found that fair value income is considerably more value relevant than historical cost income. The study also found that fair values are more value relevant for the investment fund industry than for the real estate industry. As the valuation of real estate is arguably more subjective than the valuation of financial instruments, the evidence suggests that fair values become less relevant when the possibilities for earnings management and subjective estimation increase.

Kolev (2008) used a sample of 177 large financial institutions (banks, financial service companies and insurance companies) listed in the United States, and their quarterly statements from the first two quarters of 2008, to examine whether investor see financial instruments valued internally by the company (i.e. mark-to-model assets) as less value relevant than financial instruments for which reported values have been retrieved directly from financial markets (i.e. mark-to-market assets). Kolev (2008) found a significant positive association between share prices and net assets measured at fair value, which suggests that fair values are

relevant to for equity valuation. The author also found that regression coefficients of internally valued assets were consistently lower than those of mark-to-market assets. This finding indicates that as the subjectivity of inputs used in valuation models increases so does also the information asymmetry between the corporation and investors. This finding has clear implications for the real estate market where the valuations of individual properties are largely subjective and values cannot be directly observable from the markets.

Goh et al. (2009) use a very similar setting to Kolev (2008) and analyze whether financial instruments valued internally by the company are priced differently from more objectively valued financial instruments. Their sample consisted of 516 banks listed in the United States and data from the first three quarters of 2008 was used to answer the research questions. Similar to the findings of Kolev (2008), the results of Goh et al. (2009) suggest that internally valued assets are generally priced with lower coefficients compared to mark-to-market assets.

A third study on differences between the valuation of mark-to-model and mark-to-market assets has been conducted by Song et al. (2008). Similarly to Goh et al. (2009) the authors used a sample of quarterly reports from listed US banks for the first three quarters of 2008. Even though the authors' first hypothesis was quite similar to the previously discussed two studies, their second hypothesis provides a new perspective on the subject: They set out to analyze whether the level of corporate governance in the company has an effect on the value relevance of the different types of fair value instruments. According to the researchers, the value relevance of mark-to-market instruments declines only marginally when the company lacks quality corporate governance mechanisms (e.g. independent directors). In contrast, for mark-to-model assets the decline in value relevance caused by bad corporate governance is more significant. The results show that strong corporate governance reduces information asymmetries and enhances investor confidence in internally generated valuation models.

One of the most interesting studies from the viewpoint of this paper research has been conducted by Barkham and Ward (1999). The authors used a sample of UK property companies to analyze how changes in the relation between properties valued at cost and total properties affect the NAV discount. The results showed that the higher the proportion of properties valued at cost (relative to total properties) the lower the NAV discount. The results indicate that properties valued at cost are more value relevant than properties valued at fair value. These findings seem to be contradictory to the research described previously which has suggested that fair values are more value relevant than valuations based on historical cost. Other studies have also shown that fair values of property assets are less biased and more accurate than values based on historical cost (Dietrich et al. 2001).

However, there seems to be a logical explanation for the results of Barkham and Ward (1999). Property values have historically tended to increase over time which has led to properties valued at cost becoming "undervalued". Also, real estate companies are usually valued by financial markets below their NAV (hence the NAV discount) and the NAV tends to be reported at fair value. However,

in cases where the NAV (i.e. the properties) is valued at cost, there is already a discount built into the reported valuation due to the under-pricing of the assets. This means that there is no need for the financial markets to value the reported NAV at a discount to the same extent as when properties are valued at fair value.

Similar results to Barkham and Ward (1999) have also been found by Lourenco and Curto (2008) who used a sample of listed real estate firms from four European countries (France, Germany, Sweden and UK) to investigate whether investment properties valued at cost and investment properties valued at fair value are priced differently by investors. The sample consisted of 224 observations from 2005 to 2007 and the results confirmed the researchers' initial assumption that properties valued at cost are more value relevant than properties valued at fair value.

In summary, previous research indicates that in general fair values are more relevant for asset pricing than any of the alternative valuation methods (e.g. historical cost). However, this does not always hold true for real estate assets. In some cases properties valued at acquisition cost seem to be more value relevant than fair value properties. However, the most important conclusion in terms of the current paper is that the value relevance of fair values declines when the possibilities and incentives for misreporting increase. This finding can be assumed to hold true both for investment properties and for other asset classes. The disclosure of additional information related to valuations (such as sensitivity analyses) aims at tackling this problem by reducing the uncertainty that investors see in the asset values that are based on models requiring subjective inputs.

3.2 NAV Discounts

The literature on NAV discounts is relevant for this paper as the research is closely linked to the discussion on the reliability of reported property values. Academics have tried to provide reasons for the NAV discount anomaly but no common understanding has yet been reached. However, research has been able to generate a long list of company specific factors which could affect, and partially explain, the discount.

Leverage is one of the variables that have been studied in connection with NAV discounts. However, the theoretical relationship is two-fold. On one hand, an increased leverage ratio could be seen as a disciplinary mechanism which provides management with an incentive to act diligently. This point of view supports the conclusion that increasing debt levels decrease NAV discounts. On the other hand, an increased leverage ratio also makes the possibility of a default more probable. This viewpoint supports the argument that an increased leverage ratio should increase the NAV discount. (Bendetto & Morri, 2009) Previous literature has mostly supported the latter argument. For example, Barkham and Ward (1999) found that the relation between debt and NAV discount is positive. Bond and Shilling (2004) and Brounen and Laak (2005) have also found evidence that supports this train of thought.

The size of listed real estate companies and closed-end funds has also received a lot of interest. Many authors claim that larger companies have better

access to capital markets, they are able to take part in larger and more lucrative deals, their shares have better liquidity, and they are able to profit from economies of scale. Also, size is often used as a proxy for risk (i.e. the larger the company, the smaller the risk). This line of reasoning would suggest that the larger the company, the smaller should the NAV discount be. Previous literature has also supported this hypothesis. Allen and Sirmans (1987) were able to show that announcements of REIT mergers decreased NAV discounts and the authors argued that this was due to the increased size of the merged company. Capozza and Lee (1995) found strong evidence that smaller REITs trade at a discount compared to large REITs. Similar results were also achieved by Brounen and Laak (2005) and Clayton and McKinnon (2001).

Diversification is another factor which can be argued to act as a proxy for risk. Diversification often goes hand-in-hand with size but it has also been studied separately. However, these studies have not found any conclusive evidence on the matter. Bond and Shilling (2004) used the level of unsystematic risk as a proxy for diversification and found that the NAV discount decreases when diversification increases. Brounen and Laak (2005) used another proxy for diversification, namely geographical spread of investments. They found no statistically significant relation between diversification and the NAV discount. Capozza and Lee (1995) used a diversification index in their research setting and their results showed that the relationship between diversification and NAV discount is dependent on the property type that the company concentrates on. It can be concluded that the results on the impact of diversification are mixed.

Barkham and Ward (1999) argued in their research that insider ownership would align the interest of management with the interests of owners. This would lead to lower NAV discounts as investors would not have to worry about management making decisions that are not in their best interest. This train of thought is also very common to a wide variety of corporate governance literature (e.g. Warfield & Wild, 1995) and is based on the idea that management with conflicts of interest destroy shareholder value and thus justify a larger NAV discount. Malkiel (1995) argued that investors are normally able to make a quick one-off profit by liquidating a company which is selling at a discount, but if management has a significant ownership in the company this will not necessarily be possible. According to Malkiel's (1995) argument insider ownership would lead to larger NAV discounts. However, Malkiel's (1995) logic does not provide a reason for the existence of the initial NAV discount; it only explains the longevity of these discounts. Barkham and Ward (1999) did an empirical study on the subject but found no statistically significant relation between insider ownership and NAV discount. Clayton and McKinnon (2001) also studied the subject but were unable to find significant results. Therefore, even though the logic behind Barkham and Ward's (1999) argument is widely accepted, empirical research has not been able to confirm it.

Another variable that has been widely studied is reputation. The logic for the relation between NAV discounts and reputation is largely the same as and with NAV discounts and insider ownership. Good management is more likely to

increase than to destroy shareholder value and the assets owned by the company are therefore more likely to be valued at par or even at a premium. Also, the reputation of good management usually makes funds and companies more popular among investors, which leads to higher valuation multiples, and thus to a lower NAV discount. The main problem in this approach is to find suitable proxies for management reputation. The most common proxy used in research is the performance of the share price. This approach was adopted by Barkham and Ward (1999) and they found that increased management reputation leads to a decreased NAV discount. Similar findings were made by Brounen and Laak (2005). Morri et al. (2005) used a different approach by forming a proxy for reputation from the relation of management bonuses to total salaries. They also found supportive evidence for the presented arguments.

Research has also been conducted on the relationships between NAV discounts and unrealized capital gains tax liabilities (e.g. Adams & Venmore-Rowland, 1989 and Barkham & Ward, 1999), liquidity (e.g. Capozza & Seguin, 1999), management expenses (e.g. Malkiel, 1995; Barkham & Ward, 1999), institutional ownership (e.g. Clayton & McKinnon, 2001; Morri et al. 2005) and performance (e.g. Morri et al. 2005; Morri, 2006). However, the results of these studies are not relevant for the purposes of this paper.

In summary, the NAV discount literature seems to indicate that the discount is affected by general risk characteristics of the company and the property portfolio (i.e. leverage and diversification) and by the markets' assessment of management's incentives, and whether they are aligned with the incentives of the investors. It could be hypothesized that the importance of incentives is a reflection of the level of subjectivity embedded in the property valuations.

3.3 Hypothesis Development

Even though there are some conflicting results in the surveyed literature most of the research clearly indicates that the value relevance of reported property values increases when the risk and uncertainty associated with a company decreases. Similarly, as the trust that financial markets place in the management of a company increases, value relevance increases.

The hypothesis is based on these aforementioned principles. Because property appraisal requires the extensive use of subjective estimates, it is assumed that the disclosure of sensitivity analyses reduces the risk and uncertainty that investors associate with the reported valuations and thus increases the value relevance of these assets. Based on the surveyed literature the following hypothesis is formed:

> The positive relationship between the fair value of investment property and market value of equity is lower for companies which do not provide a sensitivity analysis for their valuation when compared to companies that do provide such an analysis.

4 Data and Methodology

4.1 Sample Selection

The sample and methodology used is largely identical to the approach taken by Laakso (2016). The data set used by Laakso (2016) has been supplemented with data on the disclosure of sensitivity analyses.

The sample used to test the hypothesis consists of European publicly listed real estate companies that have been classified according to the Global Industry Classification Standard (GICS) to the *Real Estate* industry group.

The initial sample was extracted from the *Thomson Financial Datastream* and *Thomson Financial Worldscope* databases. This initial sample consisted of 363 companies. A total of 261 companies were eliminated from the sample due to lack of available data or other similar reasons which would have prevented a robust regression analysis to be carried out. For more information on the reasoning behind the eliminations made see Laakso (2016). The methodology yielded a final sample of 102 companies. Table 1 illustrates the sample selection process.

Table 1. *Sample selection.*

Step	Change	Observations
All companies with GICS code 4040 (initial sample)	363	363
Eliminated due to lack of regression inputs from databases	–64	299
Eliminated due to not valuing properties at fair value	–12	287
Eliminate due to lack of financial statement information in English, Finnish, Danish, Swedish or Norwegian	–127	160
Eliminated due to unconventional fiscal year	–37	123
Eliminated due to insufficient IAS 40 disclosures	–11	112
Eliminated due to investment property representing below 15% of total assets	–4	108
Eliminated due to P/B-ratio being below 0.2	–6	102
Final sample		102

Data on the amount of investment properties held by sample companies was collected manually from the annual reports for fiscal year 2012. All other variables required for the regression model was collected from the *Thomson Financial Datastream* and *Thomson Financial Worldscope* databases. All of the collected data was converted into Euros based on the exchange rates provided by the European Central Bank for the date 31.12.2012.

4.2 Research Methodology

The regression model used to answer the research hypothesis is based on Laakso (2016) who built on previous value relevance literature by Barth and Clinch (1998), Lourenco and Curto (2008), Kolev (2008) and Song et al. (2008). For more details on the model see Laakso (2016).

The regression model divides fair value properties into two different variables: Properties owned by companies that disclose a sensitivity analysis (*SensitiveProperties*) and properties owned by companies that do not disclose such an analysis (*UnsensitiveProperties*). The regression model is presented below.

$$Price = \alpha + \beta1*SensitiveProperties + \beta2*UnsensitiveProperties + \beta3*NetBookEquity + \beta4*NetIncome + \varepsilon \quad (1)$$

Where:

Price	Market value of company shares on March 31st 2013
α	Intercept
β1–β4	Regression coefficients
SensitiveProperties	Book value of properties for companies that disclose a sensitivity analysis
UnsensitiveProperties	Book value of properties for companies that don't disclose a sensitivity analysis
NetBookEquity	Book value of equity subtracted by *ExternalProperties* and *InternalProperties*
NetIncome	Net income
ε	Residual

The market value of the companies' shares is based on the share price on 31 March 2013. This is done in order for markets to have time to effectively transfer the information included in the annual report into the share price. A similar approach has also been used by previous authors (see e.g. Biddle et al. 1997, Beaver et al. 2007, Entwistle et al. 2010 and Barth et al. 1998).

4.3 Limitations

The sample selection methodology suffers from the possibility that some companies might be subsidiaries of other sample companies. This might lead to the same assets being accounted for twice which could distort the results of the regression models. The problem is not seen as too severe to significantly decrease the reliability of the results. It should also be noted that differences in the subsamples that are compared to each other (*SensitiveProperties* and *UnsesitiveProperties*) have to be taken into account when the results of the regression models are evaluated.

The time frame of the study is confined to only one year which might limit the generalizability of the results. The small sample size also creates its limitations for the generalizability of the results. Another factor worth considering is the limited industry coverage of the study. While real estate investment companies are the main holders of investment property, this limitation in the sample creates uncertainty about the possibilities of generalizing results into other industries.

Finally, the method for presenting and calculating sensitivity analyses has not been standardized in any way, which also presents problems for the methodology of the paper. The way in which companies present sensitivity analyses differs to some extent, which means that they are not always directly comparable. However, this issue is not expected to invalidate the results of the analysis. For further discussion on the limitations of the methodology used see Laakso (2016).

5 Results

5.1 Correlation coefficients

Tables 2 and 3 present Pearson and Spearman correlation coefficients for the variables used in the regression model. Two-tailed testing is used because relationships between tested variables can exist in both directions. The analysis commences by looking for signs of multicollinearity between the independent variables. Only one statistically significant strong correlation (i.e. $r > 0.70$ or $r < –0.70$) is found between independent variables (Linneman, 2011; Willoughby, 2015). Such a correlation is found between *UnsensitiveProperties* and *SensitiveProperties*. This strong relation is supported only by the Spearman correlation (–0.815) as the Spearman correlation for this relation is not statistically significant. The two strongly correlated variables are mutually exclusive, i.e. if an individual company has properties categorized into one of these variables, it cannot have properties categorized in to the other. The negative relationship between the variables is therefore very logical and do not undermine the reliability of the model.

Moderate correlations (i.e. $0.30 < r < 0.70$ or $–0.30 > r > –0.70$) and weak correlations (i.e. $0.00 < r < 0.30$ or $0.00 > r > –0.30$) can be found between several independent variables (Linneman, 2011; Willoughby, 2015). The correlations between these variables are logical in nature. For example, both of the property variables (SensitiveProperties and UnsensitiveProperties) have a moderate negative correlation with NetBookEquity which is understandable as NetBookEquity is the result of subtracting properties from equity. Because the moderate correlational relationships are logical and have the expected signs, and because only one significant strong correlation between independent variables was found, I conclude that no serious multicollinearity exists in the regression model. This conclusion is supported by the collinearity statistics in Table 4, which will be analyzed in more detail later.

When examining the correlations between the dependent variable (*Price*) and the independent variables, preliminary supportive evidence for the hypothesis is found. No statistically significant Spearman correlation can be found between *SensitiveProperties* and *Price* and no conclusions can therefore be drawn based on this correlation statistic. However, the Pearson correlations for both *SensitiveProperties* and *UnsensitiveProperties* are statistically significant at the 0.01 confidence level. The correlation between *Price* and *SensitiveProperties* is 0.824 while the correlation between *Price* and *UnsensitiveProperties* is only 0.329. This large difference in the correlation coefficients indicates that the value relevance of properties is larger for companies which provide sensitivity analyses in comparison to companies that do not. Similarly to previous models the correlation between *Price* and *NetBookEquity* is negative (Pearson –0.836; Spearman –0.816). *NetIncome* and *Price* have a positive correlation (Pearson 0.693; Spearman 0.508) which indicates that the control variable has explanatory power.

Table 2. *Pearson correlations for the variables of regression model.*

		Net-Income	**Market-Cap**	**Un-sensitive-Proper-ties**	**Sensitive-Proper-ties**	**NetBook-Equity**
NetIncome	Correlation	1				
	Sig. (2-tailed)					
Price	Correlation	.693**	1			
	Sig. (2-tailed)	.000				
UnsensitiveProperties	Correlation	.113	.329**	1		
	Sig. (2-tailed)	.260	.001			
SensitiveProperties	Correlation	.529**	.824**	–.173	1	
	Sig. (2-tailed)	.000	.000	.082		
NetBookEquity	Correlation	–.393**	–.836**	–.574**	–.667**	1
	Sig. (2-tailed)	.000	.000	.000	.000	

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 3. *Spearman correlations for the variables of regression model.*

		Net-Income	**Market-Cap**	**Un-sensitive-Proper-ties**	**Sensi-tive-Proper-ties**	**NetBook-Equity**
NetIncome	Correlation	1.000				
	Sig. (2-tailed)					
Price	Correlation	.508**	1.000			
	Sig. (2-tailed)	.000				
UnsensitiveProperties	Correlation	.359**	.367**	1.000		
	Sig. (2-tailed)	.000	.000			
SensitiveProperties	Correlation	–.138	.171	–.815**	1.000	
	Sig. (2-tailed)	.167	.086	.000		
NetBookEquity	Correlation	–.321**	–.816**	–.282**	–.282**	1.000
	Sig. (2-tailed)	.001	.000	.004	.004	

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

5.2 Collinearity

Table 4 presents the collinearity statistics for the regression model. As the values for the condition index are significantly smaller than the critical value of 30 (serious multicollinearity) there is supportive evidence for the previous inference, namely, that there are no significant problems with multicollinearity in the regression model. Because all the values for the condition index are also below the critical value of 15 (possible multicollinearity) it can be stated with confidence that no multicollinearity exists in the regression model. This conclusion was also supported by the low correlation coefficients between the independent variables.

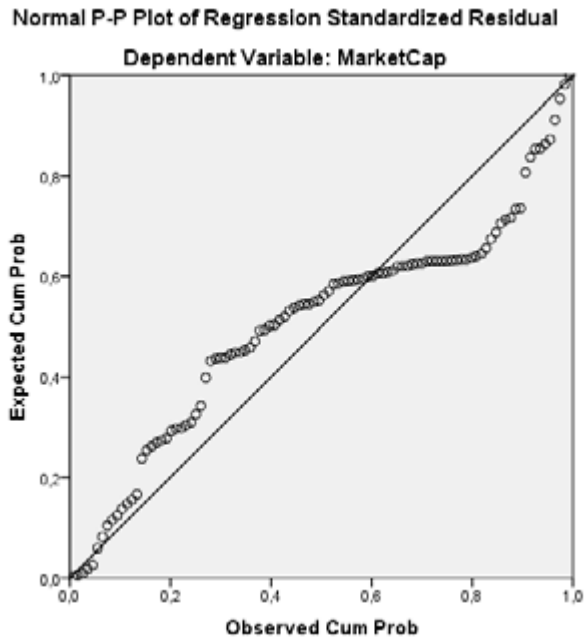

Figure 1. *Normal P-P Plot of standardized residuals and predicted values.*

Table 4. *Collinearity statistics for regression model.*

Dimension	**Eigenvalue**	**Condition Index**	**Variance Proportions**				
			(Constant)	Net-Income	Sensitive-Properties	Unsensitive-Properties	NetBook-Equity
1	2.650	1.000	.04	.03	.00	.00	.00
2	1.221	1.473	.07	.10	.01	.02	.00
3	.628	2.054	.34	.24	.01	.02	.00
4	.484	2.341	.49	.31	.01	.00	.02
5	.016	12.787	.07	.32	.96	.95	.98

5.3 Homoscedasticity

Homoscedasticity and normality of residuals for the regression model are analyzed by plotting a p-p plot of standardized residuals and predicted values. The results are presented in Figure 1 above. The plot indicates that the regression model includes some tendency in the error terms. The plot of residuals fits the expected pattern well enough to support a conclusion that the residuals are to a large extent normally distributed. However, moderate tendency in error terms might be present. This does not invalidate the regression model but it should be taken into account when interpreting the results.

When heteroscedasticity is present the standard errors might be biased which could lead to bias in test statistics and confidence intervals. However, if heteroscedasticity is not significant, OLS significance tests should be unaffected

(Asteriou & Hall, 2007). The results can therefore be utilized without concern of serious distortion.

5.4 Model summary and regression coefficients

Table 5 below provides the model summary for regression model. Based on the R-square value the model is able to predict 95.8 percent of the variance in the dependent variable (i.e. market value of equity). If the adjusted R-square value is used the prediction power of the model falls to 95.6 percent. Because only 4.2 percent of the variance is left unexplained, the explanatory power of the model is concluded to be very high. The sample is representative of the whole population as the difference between the R-square value and the adjusted R-square value is only 0.2 percentage points. In other settings such a high explanatory power could suggest possible circularity in the model. However, due to the very strong logical relationship between the asset and market values of real estate companies this theoretical possibility is not seen as risk in the model.

The summary table shows us that the Durbin-Watson statistic for the model is 1.785. Because the statistic is between the two critical values of 1.5 and 2.5, it is assumed that there is no significant first order linear autocorrelation in the regression data. Nevertheless, the value is different from the optimal value of 2.0 which would indicate that there is absolutely no autocorrelation. Even though the possible slight autocorrelation does not invalidate the regression model, it should be taken into account when interpreting the results of the model.

Table 5. *Model summary for regression model.*

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.979	.958	.956	391,144,952.71	1.785

Table 6 below provides the regression coefficients for the regression model. The p-values show that all of the coefficients are statistically significant at the 0.01 confidence level. The unstandardized regression coefficients show that a one Euro change in the value of *SensitiveProperties* leads to a 0.782 Euro change in the value of *Price,* while a similar change in *UnsesitiveProperties* only leads to a 0.696 Euro change in *Price*. The effect of *SensitiveProperties* is larger (12.4 percent), which supports the hypothesis (i.e. the value relevance of properties supported by a sensitivity analysis is higher than the value relevance of properties

Table 6. *Regression coefficients for regression model.*

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Variable	B	Std. Error	Beta		
(Constant)	–129840340.849	48348476.304		–2.686	.009
NetIncome	1.433	.267	.156	5.371	.000
SensitiveProperties	.782	.055	1.217	14.121	.000
UnsensitiveProperties	.696	.063	.811	11.092	.000
NetBookEquity	.469	.088	.503	5.352	.000

which are not supported by such an analysis). The coefficient of *NetBookEquity* is 0.469 which is lower than the coefficients for either of the property related variables. This is logical when one takes into account that *NetBookEquity* includes several asset classes which have to be valued based on highly subjective estimates of future cash flows (e.g. intangible assets and goodwill).

The standardized regression coefficient for *SensitiveProperties* is 1.217 while the coefficient for *UnsensitiveProperties* is 0.811. A one standard deviation change in the amount of *SensitiveProperties* results therefore in a 1.217 standard deviation change in the market value of equity. A change of similar magnitude in the amount of *UnsensitiveProperties* leads only to a 0.811 standard deviation change in the market value of equity. The effect of *SensitiveProperties* is over 50 percent larger than the effect of *UnsensitiveProperties*. The results provide additional support for the hypothesis and it is therefore concluded that the provision of sensitivity analyses does increase the value relevance of investment property.

6 Conclusions

The purpose of this study, inspired by the findings of a previous paper by Laakso (2016), was to find out whether financial markets perceive reported values of investment properties as more trustworthy when the disclosed valuations are supported by sensitivity analyses. This question is of central importance both to the work of standard setting bodies and to the management of companies who want financial markets to fully reflect the underlying fundamental values of their assets.

A regression model was constructed to compare the value relevance of properties supported by sensitivity analysis to properties without such supportive analysis. The results confirmed the research hypothesis as the regression coefficients of properties supported by sensitivity analysis were larger than the coefficients of properties without sensitivity analysis. I thus concluded that disclosing additional information with regard to the sensitivity of property values seems to decrease the uncertainty that investors associate with these values.

At a more general level the findings suggest that corporations should strive towards increased transparency to minimize information asymmetries between management and investors. Such practices should also lead to increased value relevance for the disclosed asset valuations. The provision of detailed sensitivity analyses is currently not required by the IFRS standards. The findings suggest that the International Accounting Standards Board (IASB) should consider introducing such a requirement to increase the usefulness of financial statement information to investors.

Furthermore, during the data collection phase it was noted that the way in which corporations conduct sensitivity analyses differ significantly which creates problems in terms of comparability of the provided information. Consequently, there is also a need to standardize the way in which information on sensitivity analyses is provided. A possible standard requiring sensitivity analyses to be disclosed would therefore also need to be supported by further guidance on the harmonization of the ways in which this information is presented.

Several possibilities for further research on the subject arise. The results of the study could be questioned based on the relatively small sample size. For this reason, it would be beneficial to conduct similar studies with larger sample sizes. The sample could also be widened to encompass other industries besides real estate.

The findings imply that more detailed information on the sensitivity of the inputs used in the valuation models should be provided to financial markets. Risk and uncertainty is reduced when financial markets have more information on input sensitivity, which results in markets placing more trust in the values generated by these models. Further research could be conducted in order to find out what is the optimal level of detail of the disclosed sensitivity analyses. This information could be used as further guidance to support standard setters in their work.

Finally, the reliability of the findings could be increased if additional analysis was performed with different research approaches. Regression models could be constructed based on interaction terms instead of simply dividing investment properties into two different variables. The statistical significance of the differences in regression coefficients could also be explored further.

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Appendix 1: Descriptive Statistics

Descriptive Statistics of Sample Companies

	N	Mean	Std.,Deviation	Minimum	Maximum	25,percentile	50,percentile	75,percentile
TotalAssets	102	2,456,481,112	3,787,586,600	2,319,790	29,571,100,000	318,299,372	1,139,579,500	3,052,394,750
TotalEquity	102	887,440,283	1,496,842,156	2,180,830	12,902,500,000	139,403,750	437,946,500	1,274,037,586
TotalDebt	102	1,222,352,650	1,800,890,559	0	11,919,000,000	101,571,674	589,794,103	1,644,351,631
MarketCap	102	889,917,428	1,871,055,749	614,796	16,782,509,414	98,561,746	341,658,508	1,035,233,389
NetIncome	102	32,554,647	204,072,601	–1,129,005,000	1,458,700,000	–4,904,144	10,124,952	53,318,159
LongTermDebttoTotalAssets	102	35.8%	18.0%	0.0%	75.1%	26.4%	38.1%	48.3%
TotalEquitytoTotalAssets	102	41.9%	20.7%	1.2%	95.7%	29.8%	37.4%	50.3%
TotalDebttoTotalAssets	102	47.1%	18.0%	0.0%	93.1%	40.6%	50.1%	57.6%
ROE	102	2.3%	22.6%	–144.8%	63.3%	–2.0%	5.0%	11.6%
P/B	102	0.87	0.48	0.22	3.15	0.60	0.78	0.97
Bookvalueofproperties	102	2,107,482,422	3,320,227,712	2,290,000	26,658,400,000	285,858,529	948,075,581	2,861,836,575
Sensitiveproperties	35	2,626,551,244	4,526,745,461	14,097,000	26,658,400,000	306,370,590	1,976,252,000	3,212,827,698
Unsesitiveproperties	67	1,836,327,066	2,469,051,960	2,290,000	11,820,456,000	275,325,558	865,400,000	2,616,056,863
Propertiespertotalassets	102	84.2,%	15.4,%	32.4,%	99.7,%	77.5,%	89.9,%	95.1,%