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Reducing Property Appraisal Bias with Decision Support Systems: An Experimental Investigation in the South African Property Market

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Abstract

Background – Researchers have observed that valuation accuracy and valuation variation are caused by human adaptive approaches called cognitive shortcuts. Of particular interest for valuation tasks is the susceptibility of decision-makers to the anchoring and adjustment heuristic, a mental shortcut which involves deliberate and conscious adjustment of values. Various studies have shown that valuers are prone to anchoring to asking price, previous estimates, and other reference points.

Aim – The research aim is to determine the efficacy of a decision-support tool in reducing property appraisal bias.

Setting and Methods – A controlled experimental study design was used. The design in which test persons had to appraise a fictitious property is based on a German study that uses a self-written valuation software, adapted to South African conditions. The software comprises two versions, a standard software and a decision-support software. Descriptive statistics and non-parametric testing were used to interpret the results.

Findings – Despite the results not being as robust as expected, the study revealed that test subjects were susceptible to the anchoring bias and that using a decision-support tool can help reduce this and so decrease the valuation variations.

Practical implications – This study heightened the need to counter the effect of bias in valuation. Few studies have delved into debiasing methods and even fewer have used technical tools for this task. Other forms of cognitive shortcuts used by valuers should be incorporated into the decision-support tool, and a similar test run for different valuation settings.

Keywords: Appraisal Bias; Anchoring and Adjustment Heuristics; Decision Support Systems

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1. Introduction

With the advent of new technology and findings derived from computer science and other fields, interest in using computer-aided technology to improve property valuations has become the focus of much attention. Another area of increased interest is behavioural valuation research which has greatly benefitted from advances in psychology and other fields. Yet the area of overlap between using both technology and insights into human behaviour to improve valuations is largely uncharted territory. Here, decision-support systems (DSS) come into play because their purpose is to support human decision-making, including judgements and estimations, which are a core activity of property appraisals (Shim et al., 2002).

Behavioural researchers assert that valuation is a discipline of social science and must be viewed as an art not a science (Diaz & Hansz, 2007). Given that valuation is a human activity, judgement bias may occur in the form of random and systematic error, which is regarded as having a greater effect on an investor's decision than random bias would have (Yiu et al., 2006).

Valuation bias is an under or over valuation in relation to the target (Crosby, 2000). It occurs when the valuer or the valuation (i.e. the techniques, processes, systems, etc. used by the valuer) show random or systematic errors. Identifying and examining the normative descriptive gap to align with normative standards is termed 'debiasing' (Tidwell & Gallimore, 2014). Among the three main debiasing techniques Larrick (2004) identified, technological strategies such as using a DSS are perceived to be more effective than the cognitive or motivational strategies.

To mitigate or eliminate the effects of decision-making bias, DSS have been designed to assist human decision-making processes. With an improved informational display, informational search and reduced processing cost, DSS provide a cognitive incentive system that both enhances the decision-making process and reduces systematic bias. Tidwell and Gallimore (2014) and Lausberg and Dust (2017) found that decision-support technology has the potential to reduce the most prominent bias in real estate valuations: the anchoring bias. While the studies revealed the existence of anchor behaviour, they also showed that computer-based systems can be used to improve appraisal judgement, although many issues remain unresolved. Therefore, further research into the efficacy of decision-support tools presents a great opportunity, especially within the South African property valuation context.

The research question addressed in the study is:

> *To what extent can the decision support systems help reduce or eliminate property appraisal bias?*

A review of the literature indicates that no study has explored the influence of a decision-support tool in real estate valuation in the context of the South African property market. The correlation of anchoring behaviour and valuation in unfamiliar geographical locations is of particular interest (Tidwell & Gallimore, 2014). The purpose of this study, therefore, is to test the efficacy of the decision support systems in mitigating and reducing anchoring bias in the valuation process.

2. Literature Review

2.1. Property valuation and judgement

2.1.1. The valuation process

Amidu (2011) suggests that valuation is inherently a human activity and a judgemental process due to the heterogeneous nature of property and the lack of transaction information in the market. The author recognises that despite the development of a systematic and structured approach to facilitate consideration of implicit and explicit factors, which could affect valuation outcomes, judgement bias is likely to occur throughout the valuation process.

2.1.2. Accuracy and variation in valuation

In valuation variation studies, bias occurs when a valuation produced by one valuer differs from those by other valuers based on the same information and time basis. Joslin (2005), through a questionnaire survey and valuer interviews, found that uncertainty during a valuation affects the accuracy of valuation. Uncertainty in valuation arises from the quantity and quality of comparable evidence, the market condition, the characteristics of the subject property, client pressure and a valuer's subjective opinion (Joslin, 2005; Babawale & Omirin, 2012; Awuah et al., 2016).

Tidwell and Gallimore (2014) and Awuah et al. (2016) contend that the wide dispersion of market value estimates stems from the inherent characteristics of real property such as size, design, infrastructure, etc. The deficit of open market information forces valuers to use anecdotal or unsystematic information to gather market information. In addition to the disparity in market information, behavioural contention within the valuation process may lead to valuation inaccuracy and variance.

2.1.3. Decision-making, heuristics and behaviour

Simon and Newell (1971), who pioneered the theory of human problem solving, found that due to limited processing capacity, people use heuristic methods to solve problems. According to the theory, the human information-processing system operates sequentially, with most processing activities occurring in the short-term memory. However, due to the limited capacity of short-term memory and the slow storage capacity in the long-term memory, humans adapt to cognitive shortcuts called heuristics. This adaptive approach is used unconsciously as an efficient way for individuals to reduce complex tasks to simpler judgemental operations. For valuations, the heuristic behaviour is of particular importance because human judgement is central to the process.

In the literature, various types of bias arising from heuristic adaption have been identified. Relevant for this research, drawing on findings by Simon and

Newell (1971), and Tversky and Kahneman (1974) identify three types of heuristics people use regularly when forming judgements: the representativeness, availability, and the anchoring and adjustment heuristics. Later, other researchers (Arnott, 2006; Evans, 1989; Harvard, 2001a) found many more cognitive shortcuts used by decision-makers.

The anchoring and adjustment heuristic is mainly employed in numerical predictions. Rottenstreich and Tversky's (1997) study on judgement of a disjunctive event, Kruger's (1999) research of rating of one's ability to drive and Griffin and Tversky's (1992) study of confidence judgements, suggest that people use an anchor-and-adjust strategy to solve estimation problems. However, in all cases, due to insufficient adjustment, a biased judgement emerges as the final value remains biased in the direction of the original arbitrary anchor value.

The subconscious use of cognitive shortcuts described above may lead to various forms of bias. In the context of property valuation, Yiu et al. (2006), through a desktop study of appraisal bias, identified the anchoring effect, appraisal smoothing and survival biases as common types of appraisal bias. Appraisal smoothing is classified as a random bias and it arises from a tendency of appraisers to smooth their valuations by using historic data or anchoring their values to previous estimates (Figure 1). Survival bias, put forward by various studies (Bretten & Wyatt, 2001; Hansz, 2004), relates to client influence on valuations. However, while this type of bias is more systematic in nature and can affect the result to greater extent, Kishore (2006) argues that survival bias is to some extent the result of unethical behaviour by valuers, and thus not necessarily due to cognitive shortcuts.

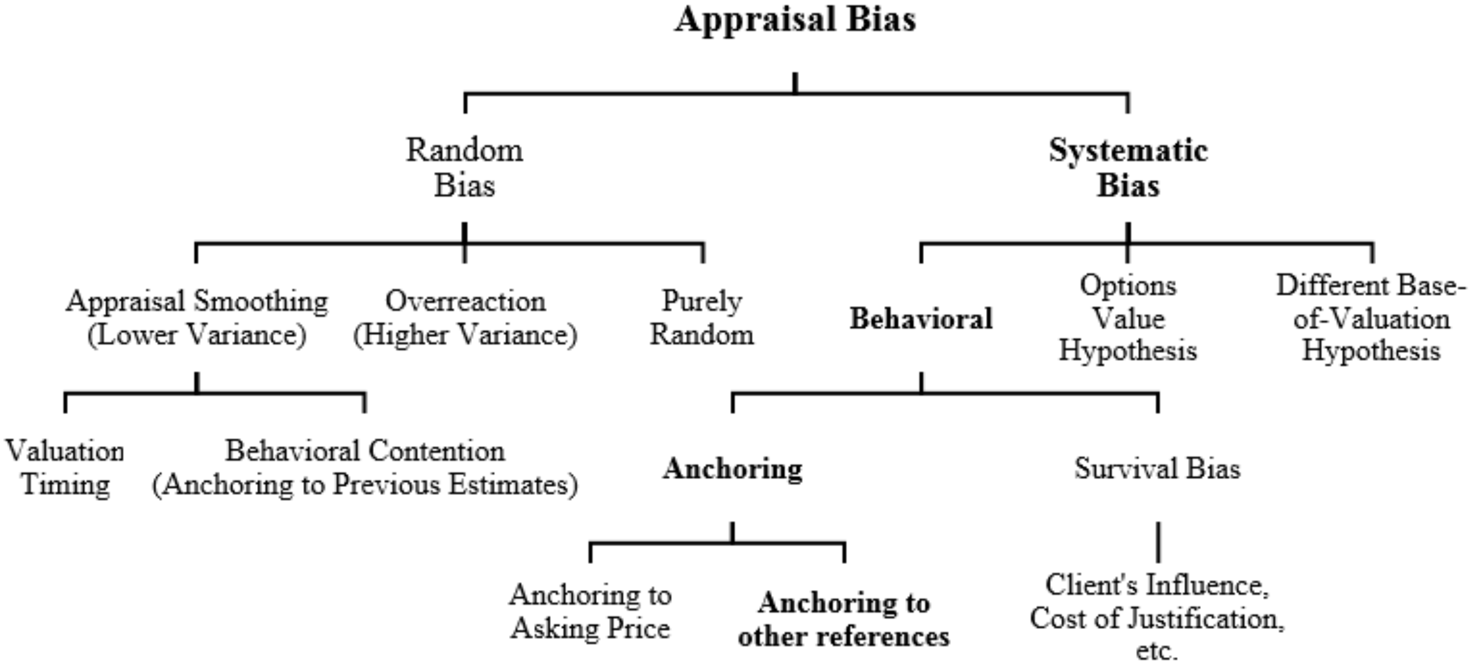

Figure 1: Appraisal bias according to Yiu et al. (2006), as depicted in Lausberg and Dust (2017, p. 334)

2.2. *Anchoring effects in valuations*

Normatively, valuers should follow valuation procedures before forming a value judgement. The valuer's task is to evaluate property-specific and market information. However, psychological theory supports the notion that valuers are also prone to mental shortcuts when carrying out a task. Anchoring effects have been observed to be prominent in real estate valuations as the market value inevitably has some subjective elements and the high need for information cannot be satisfied with low information availability (Northcraft & Neale, 1987; Tidwell, 2011).

2.2.1. Types of anchoring effects

There are two types of anchoring effects as distinguished by Epley (2004), who highlights that the anchoring effect covers almost every decision relating to the assimilation of an anchor value. The anchor value can be generated either by an external source or by decision-makers themselves. "Externally provided" anchors and "self-generated" anchors respectively lead to accessibility-based anchoring and adjustment-based anchoring. Although the anchors produce effects of similar characteristics, they are observed to be psychologically different.

Epley and Gilovich (2005) assert that "self-generated" anchors are automatically generated values that are known to be wrong but close to a right answer, and for which deliberate and conscious adjustment is required. Unlike "externally provided" anchors that produce suboptimal results due to the inconsistent retrieval of anchor-related information, "self-generated" anchors lead to adjustment-based anchoring. This heuristic behaviour arises due to insufficient adjustment resulting from a lack of attention and a "satisficing" tendency (Epley & Gilovich, 2006). An empirical study by Epley and Gilovich (2006) supports the argument of Quattrone et al. (1981) that subjects stop adjusting once a plausible result is reached. In addition, the study finds evidence that adjustment is "effortful", and it is suggested that incentives to engage in effortful thought may diminish the adjustment-based anchoring effects.

2.3. *Countering the anchoring effect in property valuations using debiasing techniques*

Various studies show that valuers do not follow the normative models of rational thinking, which explain the process and product that rational thinking should meet (Northcraft & Neale, 1987; Diaz, 1990; Quan & Quigley, 1991; Black & Diaz, 1996; Diaz & Hansz, 1997; Black, 1997; Diaz & Wolverton, 1998; Diaz et al., 1999; Havard, 2001a; Hansz & Diaz, 2001; Clayton et al., 2001). It is observed that due to the limited human processing capacity, valuers have the tendency to deviate from the normative process when forming judgements. However, the normative-descriptive gap, which leads to systematic bias in valuations, has now drawn researchers' attention to find solutions to mitigate and eliminate this gap.

2.3.1. Debiasing techniques

According to Fischhoff (1982), sources of bias are faulty tasks, misunderstanding of tasks, and mismatch between decision-making and tasks. In his debiasing strategy, he suggests that the decision-maker is the main source of biased judgement rather than the task itself. The strategy is based on an escalation design that aims to improve human performance through the following steps:

(1) Warn the decision-maker of possible deviation without giving a description of the type of bias.
(2) Describe the direction (positive or negative influence) and extent of the bias.
(3) Provide feedback and relate back to the warning message.
(4) Provide support with feedback, such as a programme of training and coaching that would help to overcome the bias effect.

Arkes (1991) supports the classification of the various causes of bias into three broad categories, namely psychophysically-based error, association-based error and strategy-based error. The author argues that adaptive behaviour is characterised by costs and benefits, which reflects a rational benefit-cost calculation in decision-making. Unlike psychophysically-based errors and associated-based judgement errors, which are regarded as associative, fast, automatic and effortless, strategy-based errors are slower, serially driven and require significant cognitive capacity (Stanovich and West, 2000). Kahneman (2003) contends that the first two adaptive behaviours are intuitive, whereas strategy-based errors are based on reasoning, which is consciously monitored and deliberately controlled.

Based on the taxonomy of judgement behaviour by Arkes (1991), Larrick (2004) identifies three main approaches to address bias. Motivational strategies in the form of incentives and accountability help improve decision performance in some cases. The incentive approach encompasses the principle that people possessing the necessary cognitive capital will apply additional effort to improve outcomes. Equally, accountability, based on the principle mechanism of pre-emptive self-criticism, improves decision-making through the motivational effects of social benefits.

Another approach is called “consider the opposite”. It relies on individuals applying different views that address the ill-structured processes of associated-based error (Chapman & Johnson, 1999). Mussweiler et al. (2000) support this approach as it directs attention to alternative evidence that may not have been considered, overconfidence and accessibility-based anchoring effects. Larrick (2004), however, argues that an over-reliance on this technique may affect decision-making accuracy or cause decision-makers to believe in such intentionally biased judgement. Yet another form of cognitive strategy is training to facilitate the learning and application of normative rules. Proper training can also help decision-makers understand heuristic behaviour and to develop the necessary skills to eliminate biased decisions.

Technological strategies in the forms of group decision-making tools, decision models and decision analysis can also improve the decision-making process. It is argued that while using a group decision system, synergies emerge from experts' interaction and error-checking improves the decision outcome. Similarly, using statistical techniques such as a multiple regression analysis or a decision tree is beneficial in assessing large data sets and analysing alternative outcomes where human processing capacity is limited. Of utmost importance is the use of computing technology to automate much of the decision analysis. DSS are arguably much more efficient as the systems reduce the cost of efforts, which hence improves the effort-accuracy trade-off (Edwards & Fasolo, 2001).

For valuation tasks that are complex in nature, adopting a socially administered practice (motivational techniques) or an individually administered practice (cognitive strategies) is impractical (Larrick, 2004). Apart from that, Epley and Gilovich (2005) argue that self-generated anchors are essential in forming a value judgement and that setting aside with cognitive strategies is counterproductive. While a systematic study of cognitive heuristics can provide normative recommendations, Gigerenzer (2004) contends that it will be difficult to know whether the solutions are feasible. As such, it is suggested that debiasing strategies should be geared towards refining the psychological processes (Epley & Gilovich, 2005). Technologists regard debiasing strategies in the form of DSS to be better at improving the psychological processes.

2.3.2. Decision support systems

With the advance in information technology, computerised systems have developed that attempt to improve the effectiveness of decision-making (Arnott & Pervan, 2005). The aim of decision support tools is to provide an interactive platform whereby computerised systems provide assistance by automating the structured part of the problem while the individual deals with the complex unstructured elements of the decision (Silver, 1991).

DSS have various attributes that can be tailored to the type of decision-making environments they support. Silver (1988) undertook a descriptive analysis and classified the systems into three tiers: functional capabilities, user view of system components, and system attributes. The first two tiers represent the information processing capabilities and the system configuration that comprise DSS. The system attributes represent the collective statements and the component relationships in a DSS, and it is generally characterised by the types of system design. According to Silver (1988), the system can be designed to restrict its users' decision-making processes (system restrictiveness), provide guidance in constructing and executing decision-making processes (system guidance) or provide specialised support for decision-making processes (system focus). These attributes determine the possible effect of the DSS on users' decision-making processes – what users can and will do to the system.

Hoch and Schkade (1996) observe that DSS research is technology-driven and mainly focuses on how decisions can be improved, while behavioural research focuses on the process of decision-making. The lack of understanding of the psychological effects and the incorporation of contemporary behavioural decision-making research limit the application and usefulness of decision-support tools (Elam et al., 1992). Hoch and Schkade (1996) demonstrate that incorporating cognitive aids into a traditional decision-support tools can effectively improve decisions. The empirical study shows that in a low predictable environment, the traditional DSS, which support human information processing limitations via a database of historical information, produce less reliable outcomes. When combining cognitive model-based support systems with traditional DSS, the forecasting task in uncertain settings has better outcomes. Similarly, Singh (1998) developed a conceptual framework to explore the efficacy of integrating aspects of cognitive aids into the technological tools for improving strategic execution.

2.3.3. Decision support systems and the cost-benefit framework of cognition

Theory asserts that decision-making is contingent upon the effort required to make a decision and the accuracy of the outcome (Payne, 1982). The trade-offs between accuracy and effort in decision-making are largely supported by various empirical, simulation and conceptual studies (Todd & Benbasat, 1991).

Kleinmuntz and Schkade (1993) argue that information displays affect decision makers' choice processes through an adaptive mechanism of accuracy and effort trade-off. Visual representations are mainly characterised by the form, organisation and sequence of information, and are defined as follows:

Form relates to the way individual items of information are displayed (such as numerical, verbal or pictorial representation).

Organisation refers to the way that individual items of information are shown in meaningful patterns or structures (e.g. table or list).

Sequence denotes the order that individual items or group of items appear (e.g. alphabetical or chronological order).

Schkade and Kleinmuntz (1994) found evidence that organisation has the greatest influence on information acquisition. While form displays primarily influenced information combination and evaluation, organisation was noted as requiring the largest effort requisition by decision-makers. Display sequence had fewer and smaller effects on acquisition processes.

Within the real estate literature, studies suggest that information presentation may influence decision-maker perception. Havard (2001b) examines the effect of information display on bias in commercial valuation and observes that a tabulated display can reduce bias in valuation. Although the extent of its effectiveness is inconclusive, the simple fact that data presentation changes the outcome of the valuation task is highly significant for decision processes. Similarly, Jin and Gallimore (2010) observe that information display, when used to manipulate framing effects, can change an individual's decision making processes.

2.3.4. Use of decision-support tools for real estate valuations

Property valuation can be done on two levels (individual or portfolio) and in two ways (one-by-one or mass appraisal). In mass valuation, automated valuation models (AVM) have become market standard. They often have built-in procedures and sometimes even artificial intelligence to eliminate bias by shifting decision power from humans to machines. This is not the case in individual appraisals. The majority of valuers either use Microsoft Excel or one of the many valuation software packages on the market. Unlike mass valuation, manual valuation software lacks the computational intelligence-based techniques. Lausberg and Dust (2017) contend that not even leading software packages such as Argus or Cougar, which otherwise provide sophisticated information handling abilities, provide the necessary support for decision-making. Hence, for studying the effect of decision-support on valuations, researchers have to either build their own experimental systems or to use other systems such as market information systems in combination with valuation software.

Using the experimental concept of Northcraft and Neale (1987), George et al. (2000) built a real estate appraisal DSS to examine the systems' efficacy in mitigating and eliminating the anchoring and adjustment bias. Their findings reinforced Northcraft and Neale's (1987) observation that subjects are susceptible to anchoring effects when exposed to an anchor value. Use of a computer-based DSS, however, did not support assumptions that with the assistance of an automated system, the strength of the anchoring and adjustment bias would be reduced. The authors speculate that the reason for anchoring and adjustment remaining robust lies within the design of the computer-based system. An understanding of the rationalisation of the process and better debiasing techniques are required for improvement.

Contrary to the findings of George et al. (2000), recent empirical studies by Tidwell and Gallimore (2014), and Lausberg and Dust (2017) show that a decision-support tool can be effective in debiasing valuation judgement. Tidwell and Gallimore (2014) use an existing proprietary tool, CoStar[1], to examine the efficacy of decision-support tools in debiasing valuation judgements of industrial vacant land. They use a two-factor randomised experiment comprising a previous expert's opinion and the introduction of a decision-support tool. Unlike the treatment group that had access to the software, the group exhibited evidence of asymmetric and divergent results. The experiment supports the thesis that use of a computer-based system may subdue the anchoring heuristic in the valuation task.

Another interesting finding by Tidwell and Gallimore (2014) is that decision support systems can encourage extensive consideration of available market

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[1] CoStar is not a DSS in the narrow sense of the word. It is in essence a database of commercial real estate information such as sales comparables that comes with sophisticated analytical tools.

information during the judgement process. A previous study by Diaz et al. (2004) revealed that valuers operating in unfamiliar markets are unlikely to increase comparable sales search. The lack of sales search effort reinforces Simon and Newell's (1971) thesis that people seek cognitive efficiency and reduce cognitive effort when faced with a complex situation. This observation, however, was made without the use of easily accessible external tools. With the decision-support tool, Tidwell and Gallimore (2014) observe and support technologists' view that high informational search costs can potentially be reduced thereby encouraging subjects to use more comparable sales information during the valuation task.

Lausberg and Dust (2017) use a self-written Microsoft Excel decision-support tool to assess the market value of an office building, integrating features of decision support believed to be effective in reducing the anchoring effect. The software consists of three levels of intervention that differ in degree of support, namely:

Standard (STD) version providing no decision support.

Modified (MOD) version introducing a simple warning message with an explanation of the anchoring effect so that test subjects can adjust their value opinion with a sliding switch.

Decision Support System (DSS) version with multiple features intended to produce more reliable outcomes such as optimised information display.

The experiment shows that with a fully supported DSS, the anchoring effect and valuation variation can be reduced. The DSS version produced more accurate market values with fewer dispersed results than the standard and modified versions. Lausberg and Dust (2017) assert that variability is reduced because users are required to follow normative procedures and are forced to spend more time on decision-making. In fact, with the requirement to compare market data sources, readings and data input to make a rational opinion, it is observed that processing time is longer with the DSS version.

On the other hand, the results were less convincing using only the modified version; the frequency distribution graph shows a distribution with outliers. While Lausberg and Dust (2017) presume that the warning message may not have been explicit enough or may have caused confusion, a similar study by George et al. (2000) shows that use of a warning message only is not sufficient to address the anchoring effects.

3. Methodology

3.1. The experimental method

Experimental research is a systematic approach that studies behaviours (dependent variables), when some factors (independent variables) are manipulated under the control of the experimenter, while other factors are held constant (extraneous variables) (Goodwin, 2009). Breakwell et al. (2012) contend that independent variables must have at least two levels of condition or situations that can be used to compare the intentional manipulation of variables. One group should comprise a treatment variable (experimental group) while the other group should have no treatment intervention (control group).

Within the valuation field, most studies on the anchoring and adjustment heuristic used experimental methods to explore the cognitive mechanisms employed by subjects. These included the works of Northcraft and Neale (1987) and Diaz et al. (1999). In the case of George et al. (2000), Tidwell and Gallimore (2014), and Lausberg and Dust (2017), computer systems were used for the experiments. The three studies used different anchors: the asking or listing price (George et al., 2000), the previous value judgement of an anonymous expert (Tidwell & Gallimore, 2014), and the book value of the property (Lausberg & Dust, 2017). The anchor was purposely set low as a previous study by Hansz and Diaz (2001) demonstrated a natural tendency to anchor towards higher values.

3.2. The research instrument

The experimental design of the research instrument used to collect data for this study, is based on the Lausberg and Dust (2017) design, with some modification to suit the South African property valuation context.

3.2.1. The subject property

For the valuation exercise, care was taken to create a case that was fictitious, but as close to reality as possible; not too complex, so it could be valued in less than 30 minutes, but with enough challenging features to make even seasoned valuers think and give them some leeway on their decisions. A Cape Town office property valuer provided information on a typical office building and current market data:

- Type and location of property: Cape Town CBD office building.
- Size and age: five units, 10 years of age with a lettable area of 1,368 sqm.
- Different lease outlet: a vacant unit and four units featuring lease terms between one and nine years.
- Tenancy information: law firms with a good credit record.
- Other attributes: aligned with law firms’ particular use, e.g. close proximity to the High Court.
- Other information: current expenses and 10 outdoor parking spaces.

The subject property was assumed to have a high rental ability, normal maintenance costs and a long useful life.

To prevent results being distorted due to differences in market knowledge, all participants received a memorandum which was similar to a broker’s information memorandum and included the following information:

- General information, location and site description, including briefing by the owner.
- Market information from various sources comprising:

- comparable and multi-sourced rental data of properties within the area;
- general office market outlook;
- operating expenses; and
- capitalisation rates.

Unlike Lausberg and Dust (2017), who used book value as an anchor value, this study uses the (low) asking price. In the South African property market, book value is not a good proxy for transaction price as it refers to the net worth of a property according to its financial statements. Similarly, assessed values, used to determine the value of a property for tax purposes, are inappropriate to use as an anchor value for the study (Cypher & Hansz, 2003). Therefore, the memorandum refers to the owner's pending sale price based on an unsanctioned expert valuation opinion of R11 million.

3.2.2. The software

The valuation system is an adaptation of Lausberg and Dust's (2017) experimental Microsoft Excel software, but with information relevant to the South African property market and some improvements.

As was observed under the previous study, the modified version did not produce conclusive results; therefore, this study only used the standard (STD) and DSS software versions.

When the Microsoft Excel version is activated, the first page contains general information and instructions to start the experiment (Appendix A). The second page provides an interface for calculating market value (Appendices C and D) and the last page collects statistical data (Appendix B). Figure 2 shows the calculation core for both the STD and DSS versions. The steps where estimations, judgements or other types of decisions have to be made are marked with an arrow, i.e., where decision-support is applicable. Obviously, this is the case for all steps except for the most basic mathematical calculations.

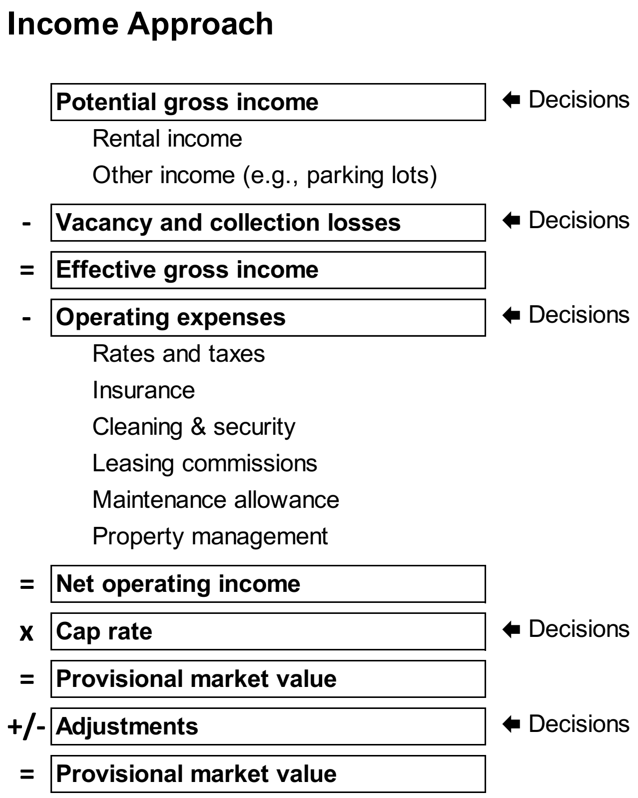

Figure 2: Calculation core for the STD and DSS versions

The standard version (see Appendices A, B and C) provides a basic setup with mandatory fields for calculating market value. The participant enters figures from the documents into the software once data has been interpreted and analysed. In this version, the programme does not support decisions arising at various levels of the decision-making process.

The decision-support tool provides various features of DSS within the basic spread sheet (see Appendices A, B and D). To avoid deviation from the normative approach, the DSS version provides a process-orientated procedure, highlighting each step to be undertaken to complete the valuation tasks. Various graphical displays, emoticons, comparable tables, explanations and data analysis features provide subjects with necessary support to evaluate the quality of market data. Warning messages and plausibility checks are incorporated into the software for attentional and correctional measures for data input that seems inappropriate. In addition to the various decision support features, the DSS version includes a final “sanity check” feature that explains the anchoring effects and allows subjects to adjust their estimate using a slider.

3.3. Hypotheses

The hypotheses to answer the research question of the extent to which decision-support systems help to reduce property appraisal bias are:

H_1: The valuation variation is lower if the valuer is de-biased and supported in his decisions.

H_2: The anchoring effect is reduced if the valuer is de-biased and supported in his decisions.

The anchoring effect was not measured. It was, however, considered an indicator that the anchoring effect was present when a participant made an adjustment to the value once the alerting function in the DSS version of the experiment was displayed.

3.4. The empirical procedure

A random sampling method was used to distribute one of the two versions of the valuation tool to the treatment and control groups. The random selection method ensures that no systematic errors occur in the data collection as every member has equal probability of being selected. Both the STD and DSS versions were issued equally.

To increase response rates, participants of the study could win an iPad or one of three iPods via a random draw. In addition to the prize, an hour of continuing education and training, approved by the South African Council for the Property Valuers Profession (SACPVP), was granted to all expert participants.

Data was either received via email or through an online tool. The raw data was debugged and updated into a master Excel file. Then, a plausibility check was carried out to identify and eliminate implausible data sets such as double entries or data with obvious input errors.

4. Analysis of Data and Discussion

4.1. Data collection

The sample consists of both expert valuers and novices. Professional valuers from the SACPVP formed the expert group. The novice group, for whom formal ethical clearance was obtained, consisted of final-year undergraduate and postgraduate students in construction studies, property studies and quantity surveying degrees at the University of Cape Town (UCT).

Most participants were contacted via email using the UCT student information system or through the South African Institute of Valuers (SAIV). The Professional and Projects Register 2010 and direct telephonic contacts were also used to identify additional contacts, to whom information was sent. The information pack consisted of a covering letter, an instruction document, a Microsoft Excel file and a memorandum containing information about the subject property and the market. Direct assistance was provided during the experimental period.

The study took place over a period of 3 months for experts and 4 months for the novices. A total of 1,345 property valuers and 183 students were officially invited to the study. Ninety-three data sets were received of which 44 were from experts (3.20% response rate) and 49 were from novices (26.78%). The response rates are in line with expectations for online surveys among these groups of respondents.

Table 1 shows that 42 experts and 46 novices were considered valid data sets. The distribution within sub-groups was fairly balanced with 52.27% being students and 47.73% being experts. The study of Lausberg and Dust (2017), on which this study is based, had a similar sample size of 43 experts and 46 novices but with a higher response rate from a lower total number of participants contacted.

Table 1 : Number of valid participants

	Standard	**DSS**	**Total**
Students	26	20	46
Experts	21	21	42
Total	**47**	**41**	**88**

4.2. Analysis of the data

The quantitative data was analysed using Microsoft Excel, the statistical software package SPSS Version 23, and R Studio. Three simple variation measures were used to assess the effectiveness of the decision support tools: range, standard deviation and variation coefficient.

To test the equality of variances, normality for the data sets is tested first. The Jarque-Bera test (jbtest) was used to measure the skewness (S) and kurtosis (K) of the sample for goodness-of-fit of a normal distribution (Bai & NG, 2015).

The Levene test of homogeneity of variance is performed for normally distributed data. For non-Gaussian distribution, the skewness and kurtosis are examined to determine the appropriate inferential procedure to employ. Either the modified robust Levene-type test or the modified robust Brown-Forsythe Levene-type test from the median with modified correction-method zero can be applied.

However, for unequal and small sample sizes, the modified robust Brown-Forsythe Levene-type test is preferred. This test is the Brown-Forsythe test adjusted using Noguchi and Gel's (2010) method, which uses a combined correctional factor with modified Hines-Hines structural zero removal method that applies a scaling factor of two.

For the assumption of homogeneity of variance not to be violated, a significance level of greater than 0.05 must be achieved (H0: VarSTD = VarDSS, p-value $\geq$ 0.05). However, the study aimed to demonstrate that the decision-support tool is more beneficial than standard tools. Hence, at the 5% significance level, the null hypothesis should be rejected, and statistically significant differences in variances between the observed groups can be concluded.

4.2.1. Testing of the first hypothesis

The first hypothesis states that the valuation variation is lower if the valuer is debiased and supported in his decisions.

$$H0: \text{Variation MVSTD} \geq \text{Variation MVDSS}$$

Testing the overall sample group

Using three variation measures, the null hypothesis should be rejected if the majority of the measures show a higher variation for DSS than for STD. Table 2 demonstrates the variation measures under the two different software versions. The market values under the STD version range from R9.82 million to R21.57 million (=120%) and are higher than the DSS version, which ranges from R9.41 million to R18.9 million (=101%). Similarly, the standard deviation is slightly higher for the STD version (=2.16) than for the DSS version (=1.98) and is confirmed by the variation coefficient.

Table 2: Variation measures

	STD	**DSS**
n	47	41
Mean	13.91	13.37
Range (min/max/%)	9.82 /21.57 /120%	9.41 /18.9 /101%
Standard deviation	2.16	1.98
Variation coefficient	15.6%	14.8%

To test the significance level of the results, the jbtest was used to examine the normality of the data. The observed asymptotic p-value for the overall sample is summarised in Table 3. Interestingly, the DSS version was normally distributed, while the STD data and the overall sample were far from a Gaussian distribution.

Table 3: Normality test

Subsets	**JB-Test p-value**	**Kurtosis**	**Skewness**
Overall Sample	0.002	1.577	0.621
STD versions	0.003	2.203	0.795
DSS versions	0.632	0.566	0.333

Using the Microsoft Excel formula to calculate excess kurtosis and skewness, it was observed that all three subsets were fat-tailed and skewed to the right (Table 3). Given the unbalanced and small sample sizes of the data, the modified robust Brown-Forsythe Levene-type test from the median with modified correction-method zero was applied (Table 4). At the 0.05 level of significance, the null hypothesis cannot be rejected (p-value =0.885) and no statistically significant difference of variance between the two groups can be concluded.

Table 4: Modified Robust Brown-Forsythe Levene-type test

Hypothesis	**Test- Statistic**	**p-value**
H_1: $Var_{STD} = Var_{DSS}$	0.0212	0.885

Testing the sub-sample groups

The same variation measures and test for significance level were used to test the effectiveness of the DSS version within the expert and student sub-samples. As shown in Table 5, the variation measures for both groups were higher under the STD version than under the DSS version.

For the expert group, the market values ranged from R12.09 million to R21.57 million (=78%) with the STD version and from R11.5 million to R18.9 million (=64%) under the DSS version. The variation coefficient indicates that the spread under the STD version was higher than for the DSS version.

The market values for students were slightly lower than those in the expert group. The values ranged between R9.82 million and R16.83 million (=71%) and R9.41 million and R15.12 million (=61%) for the STD and DSS versions respectively. The variation coefficient was also greater under the STD version, indicating a higher spread of outcomes than for the DSS version.

Table 5: Variation measures for sub-sample

	Experts		**Students**	
	STD	**DSS**	**STD**	**DSS**
n	21	21	26	20
Mean	14.52	14.30	13.41	12.40
Range (min/max/%)	12.09 /21.57 /78 %	11.5 /18.9 /64 %	9.82 /16.83 /71 %	9.41 /15.12 /61 %
Standard deviation	2.17	1.85	2.06	1.65
Variation coefficient	14.97%	12.94%	15.37%	13.30%

The box plots (Figures 3 and 4) illustrate a similar result. The DSS version produced fewer valuation variation values, and outliers in the expert group were less frequently extreme than with the standard versions.

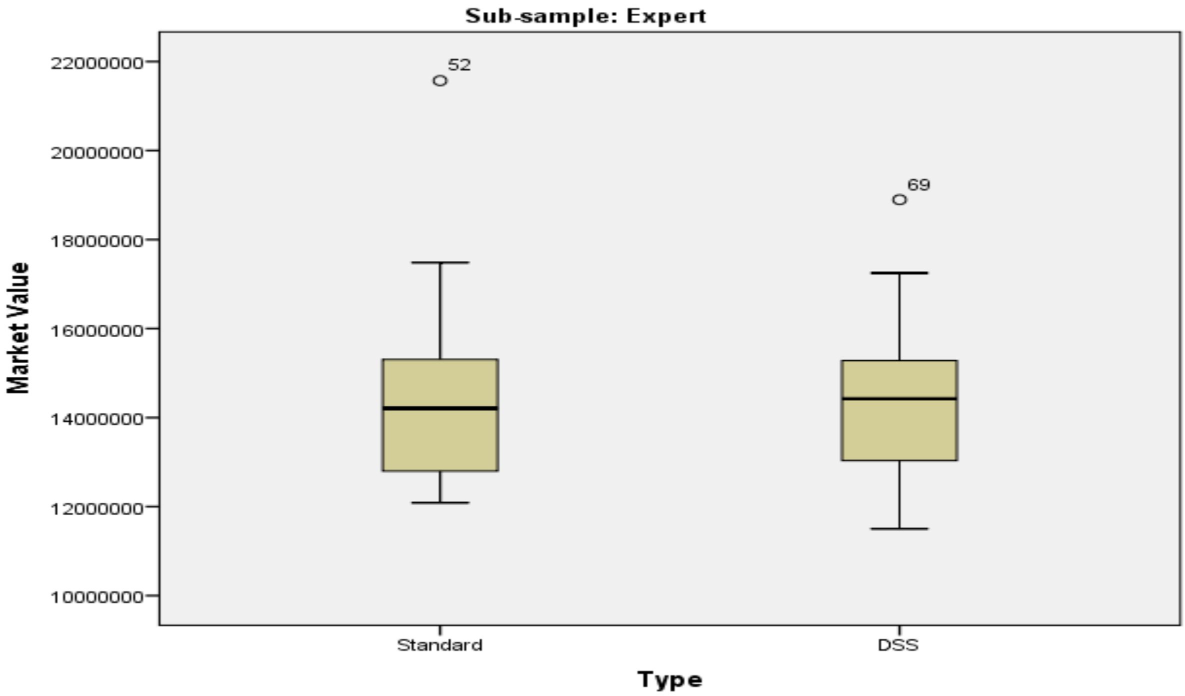

Figure 3: Boxplots comparing DSS vs STD for EXPERT sub-samples

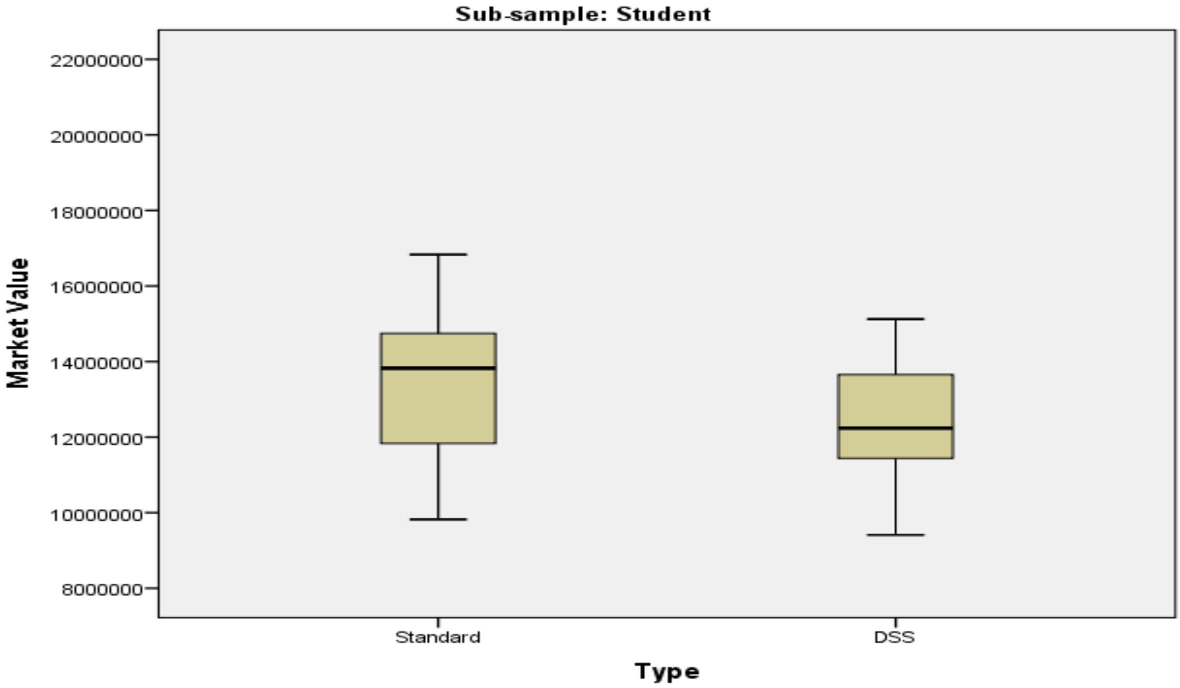

Figure 4: Boxplots comparing DSS vs STD for STUDENT sub-samples

The modified robust Brown-Forsythe Levene-type test from the median with modified correction-method zero, as shown in Table 6, produced similar statistical results to the overall groups. At the 0.05 level of significance, the null hypothesis cannot be rejected, which means that there is no statistically significant difference between the two variance groups.

Table 6: Modified Robust Brown-Forsythe Levene-type test for sub-sample

Group	Test- Statistic	p-value
Experts	0.102	0.751
Students	0.964	0.332

4.2.2. Testing of the second hypothesis

The second hypothesis states that the anchoring effect is reduced if the valuer is debiased and supported in his decision.

$$H0: \text{Mean Unadjusted MVSTD} \geq \text{Mean Adjusted MVDSS}$$

Table 7 shows the effect of the decision support tool on market values after a warning notice was issued to participants. In the 41 DSS version, 3 experts (7%) and 13 novices (n=32) adjusted the market value. This represents a 39% (n=16) adjustment when test subjects are supported in their decision. Further observations show that in nine cases (=56%), the values were negatively adjusted towards the anchor value. Similar to Lausberg and Dust's (2017) observation, the illogical adjustment could be because the warning message was not clear enough and it may have confused the participants.

After adjusting the outcomes for valuation with positive or no adjustment, it was observed that only seven participants (=22%) adjusted the market value positively. The mean adjusted market value was 1.37% higher than the mean unadjusted market value. The results were slightly higher than in Lausberg and Dust's (2017). In a similar vein, it can be concluded that some members of the test groups were susceptible to the anchoring and adjustment effect.

Table 7: Adjustment of market values with the DSS version

		Mean market value (R)		Adjustment	
		unadjusted	adjusted	Magnitude (% of the MV)	Number and % of all valuation
All valuations	Experts	14 350 106	14 297 111	-0.37%	3 (7%)
	Students	12 448 464	12 398 557	0.40%	12 (32%)
	DSS	13 422 476	13 370 987	-0.38%	16 (39%)
Only valuations with positive or no adjustment	Experts	14 082 557	14 104 662	0.16%	1 (3%)
	Students	12 351 241	12 351 241	3.40%	6 (19%)
	DSS	13 379 210	13 562 746	1.37%	7 (22%)

5. Conclusions

The findings of the controlled experiment did not provide robust results regarding the effectiveness of the decision-support tool in relation to removing or eliminating property appraisal bias. However, the study revealed some evidence that the computerised tool can help counteract the cognitive mechanism generated during valuation tasks. In particular, the warning feature, which helps identify the psychological processes of the anchoring effect, was more beneficial for novices.

When comparing the tools, descriptive statistics showed that the spread was more frequent in the STD version than in the DSS version. Similar observations were made for individual groups and for experts both with and without market knowledge.

Statistical tests showed no significance at the 0.5 level that the valuation variations would be reduced with the given DSS tool. A similar observation, at the 0.05 level of significance, was made under Lausberg and Dust's (2017) experimental research. However, unlike the German study that demonstrated some evidence of the benefits of the DSS tool at the 1% level of significance, this study could not support similar results. This can be explained by the fact that, unlike the previous study, which shows German valuers were unaware of making decisions during valuation tasks (Lausberg and Dust, 2017), in the present situation, South African test subjects were possibly more conscious when providing value judgements.

Basic descriptive statistical measurements show some evidence that the decision-support tools can help debias decisions. Although the significance test did not fully support the efficacy of the DSS tool, it is observed that at various decision levels of the valuation process, a decision support system can produce better outcomes than the standard tool. There was also evidence of the anchoring and adjustment heuristic, and it was observed that the computerised system can help counteract the unwanted cognitive mechanism generated by inexperienced decision-makers.

6. Implications for Valuation Practice and Research

The use of technological strategies to improve the psychological processes associated with valuation tasks is still at an early stage. The experimental tool Lausberg and Dust (2017) developed has demonstrated that a specific software can to some degree improve the valuation quality. That is an important goal, but obviously the software needs to be enhanced and other measures have to be taken before the tool can be useful in practice. In our opinion, there are five areas that researchers, software developers, educators and practitioners have to work on:

Firstly, the current software only incorporates anchor values from an external source. Behavioural studies undertaken by Diaz and Wolverton (1998) and others, however, have shown that experts rely heavily on their personal experience when forming a value judgement. The internally derived value opinion is a strong determinant of the final value decision. Thus, by incorporating the valuer's initial value opinion, the cognitive features of the DSS software could "weight" the final value outcome for possible anchoring effects.

Secondly, the warning messages need to be more explicit, and statistical analysis of market data and risk valuation, as identified by Lausberg and Dust (2017), should be incorporated into the decision-support tool. Moreover insights from ergonomics and computer science should be used to increase the usability and, thus, the effectiveness of the software.

Thirdly, the experiment needs to be replicated with experts on various levels of experience and expertise, for other types of properties and using different valuation methods. Other forms of heuristics, such as the representativeness and availability heuristics, should be included in the experiment to establish their impact on valuation outcomes. Furthermore, the experiment should be expanded to other debiasing methods, especially changes in process and training. In our view this type of software can be a useful supplement to existing procedures, it is not meant to replace the valuer.

Fourthly, the developers of valuation software should engage in the further development of their products in the direction of decision support. So far, most programmes are better calculators that do not support the appraiser in his decisions. However, we believe that decision support is both a key to improving the valuation quality and a means for traditional valuation tools to differentiate themselves from the automated valuation models, which are superior to them in efficiency, but often lack effectiveness.

Finally, the foundation of valuation decision-making processes must be reinforced. Behavioural contentions that have been addressed in the real estate property literature for many years must finally be discussed and presented both to students and to experts at large. Amidu (2011) highlights the needs for property valuation education, improvement in professional standards, a code of conduct, and accountability to help counteract and possibly overcome dysfunctional behaviour in value judgement tasks.

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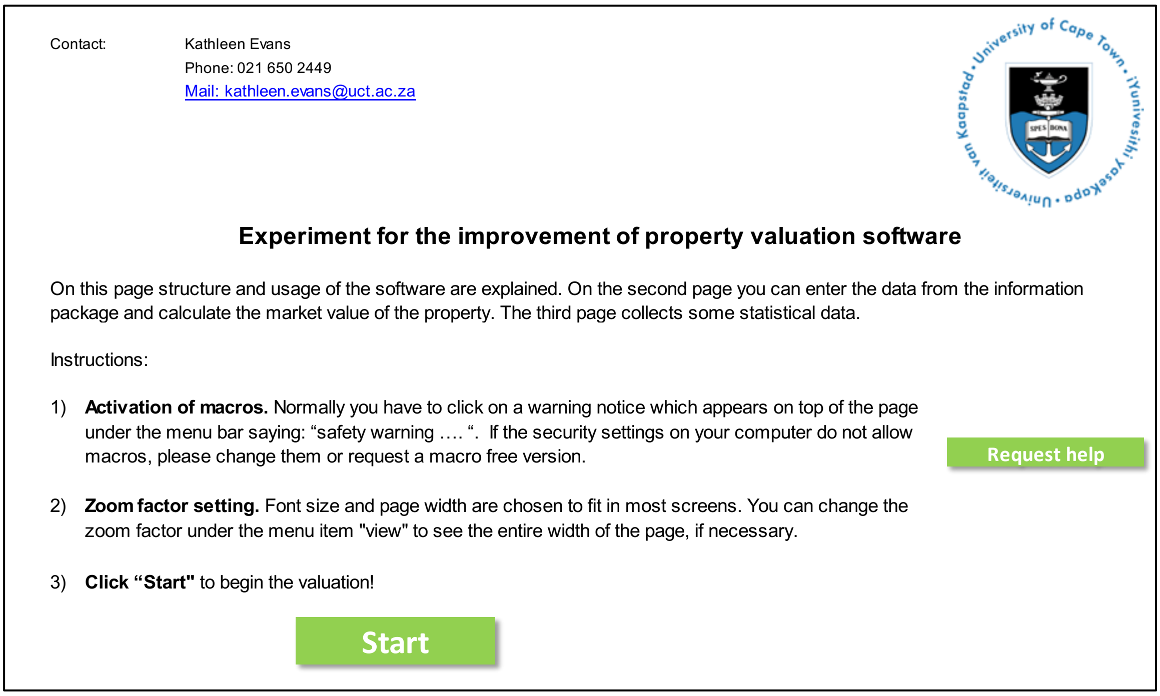
Appendix A – First page of the Valuation Tools, for both Standard (STD) and Decision Support (DSS) Programmes



Contact: Kathleen Evans
Phone: 021 650 2449
Mail: kathleen.evans@uct.ac.za

Experiment for the improvement of property valuation software

On this page structure and usage of the software are explained. On the second page you can enter the data from the information package and calculate the market value of the property. The third page collects some statistical data.

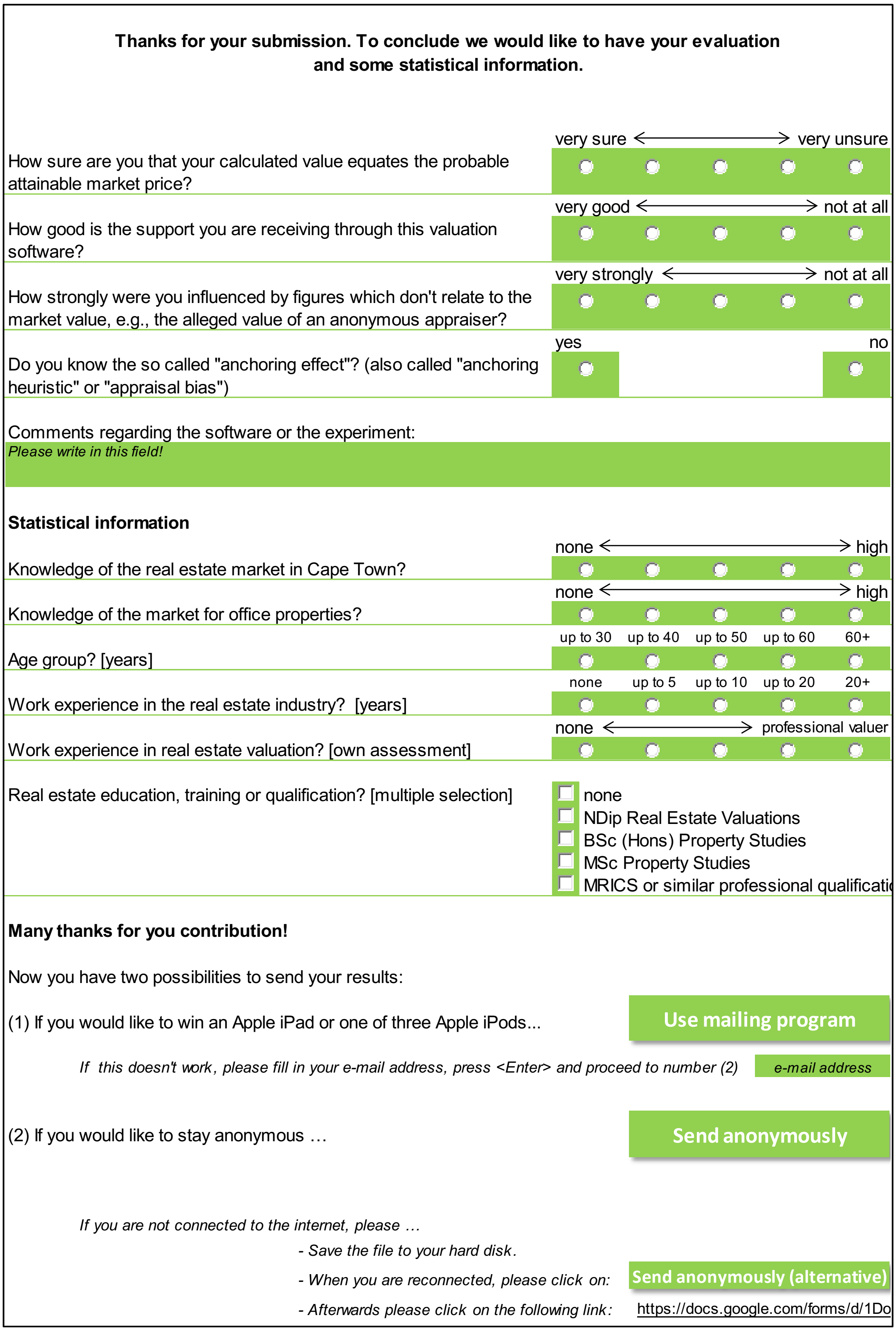
Instructions:

1) **Activation of macros.** Normally you have to click on a warning notice which appears on top of the page under the menu bar saying: “safety warning …. “. If the security settings on your computer do not allow macros, please change them or request a macro free version.

2) **Zoom factor setting.** Font size and page width are chosen to fit in most screens. You can change the zoom factor under the menu item "view" to see the entire width of the page, if necessary.

3) **Click “Start"** to begin the valuation!

Appendix B – Third page of the valuation tools, for both Standard (STD) and Decision Support (DSS) Programmes



Thanks for your submission. To conclude we would like to have your evaluation and some statistical information.

How sure are you that your calculated value equates the probable attainable market price?
very sure ⟷ very unsure
○ ○ ○ ○ ○

How good is the support you are receiving through this valuation software?
very good ⟷ not at all
○ ○ ○ ○ ○

How strongly were you influenced by figures which don't relate to the market value, e.g., the alleged value of an anonymous appraiser?
very strongly ⟷ not at all
○ ○ ○ ○ ○

Do you know the so called "anchoring effect"? (also called "anchoring heuristic" or "appraisal bias")
yes ○ no ○

Comments regarding the software or the experiment:
Please write in this field!

Statistical information

Knowledge of the real estate market in Cape Town?
none ⟷ high
○ ○ ○ ○ ○

Knowledge of the market for office properties?
none ⟷ high
○ ○ ○ ○ ○

Age group? [years]
up to 30 ○ up to 40 ○ up to 50 ○ up to 60 ○ 60+ ○

Work experience in the real estate industry? [years]
none ○ up to 5 ○ up to 10 ○ up to 20 ○ 20+ ○

Work experience in real estate valuation? [own assessment]
none ⟷ professional valuer
○ ○ ○ ○ ○

Real estate education, training or qualification? [multiple selection]
- ☐ none
- ☐ NDip Real Estate Valuations
- ☐ BSc (Hons) Property Studies
- ☐ MSc Property Studies
- ☐ MRICS or similar professional qualificati

Many thanks for you contribution!

Now you have two possibilities to send your results:

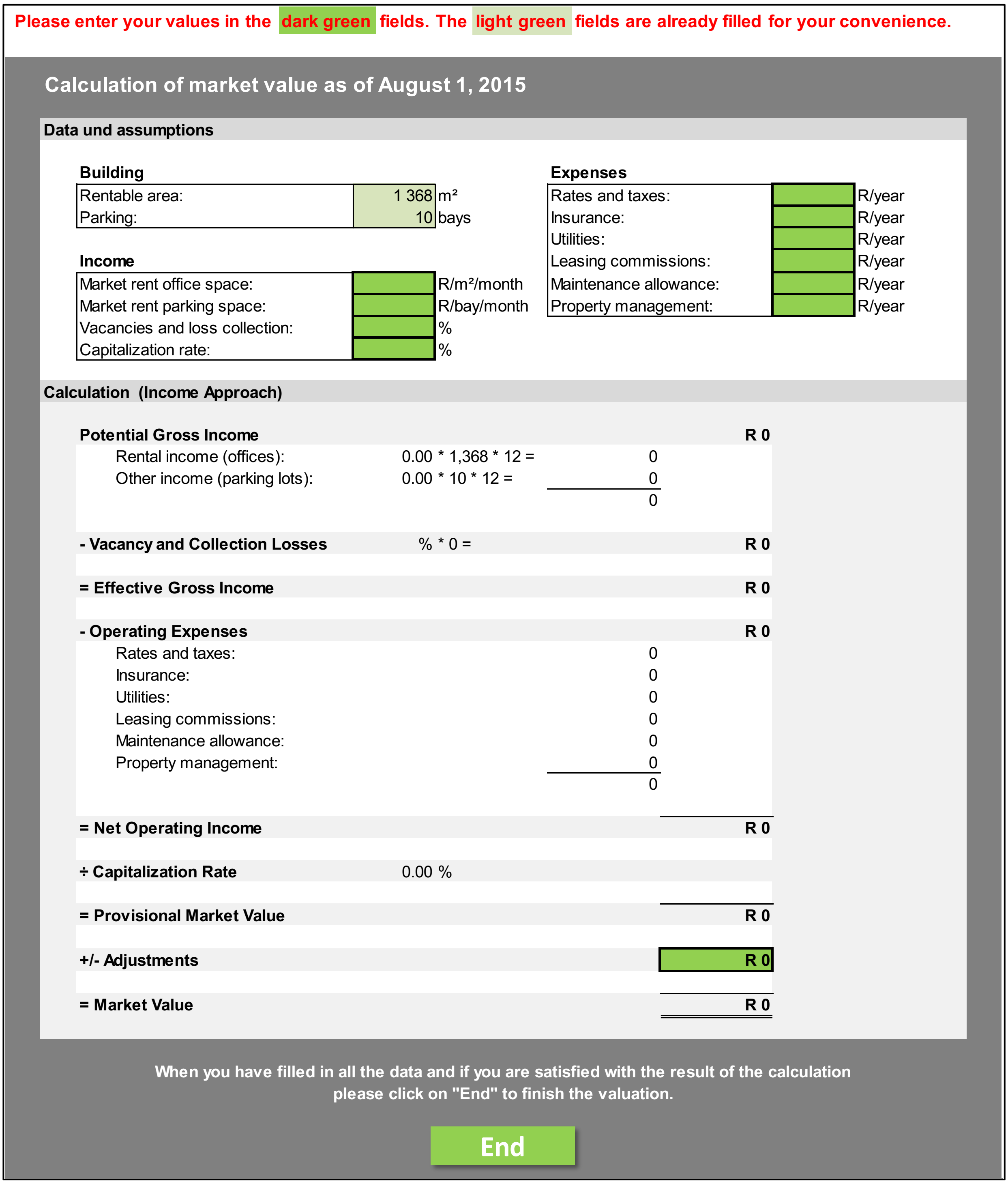
(1) If you would like to win an Apple iPad or one of three Apple iPods... **Use mailing program**

If this doesn't work, please fill in your e-mail address, press <Enter> and proceed to number (2) *e-mail address*

(2) If you would like to stay anonymous … **Send anonymously**

If you are not connected to the internet, please …
- Save the file to your hard disk.
- When you are reconnected, please click on: **Send anonymously (alternative)**
- Afterwards please click on the following link: https://docs.google.com/forms/d/1Do

Appendix C – Second page for Standard (STD) Programme Only



Please enter your values in the dark green fields. The light green fields are already filled for your convenience.

Calculation of market value as of August 1, 2015

Data und assumptions

Building

Rentable area:	1 368	m²
Parking:	10	bays

Income

Market rent office space:		R/m²/month
Market rent parking space:		R/bay/month
Vacancies and loss collection:		%
Capitalization rate:		%

Expenses

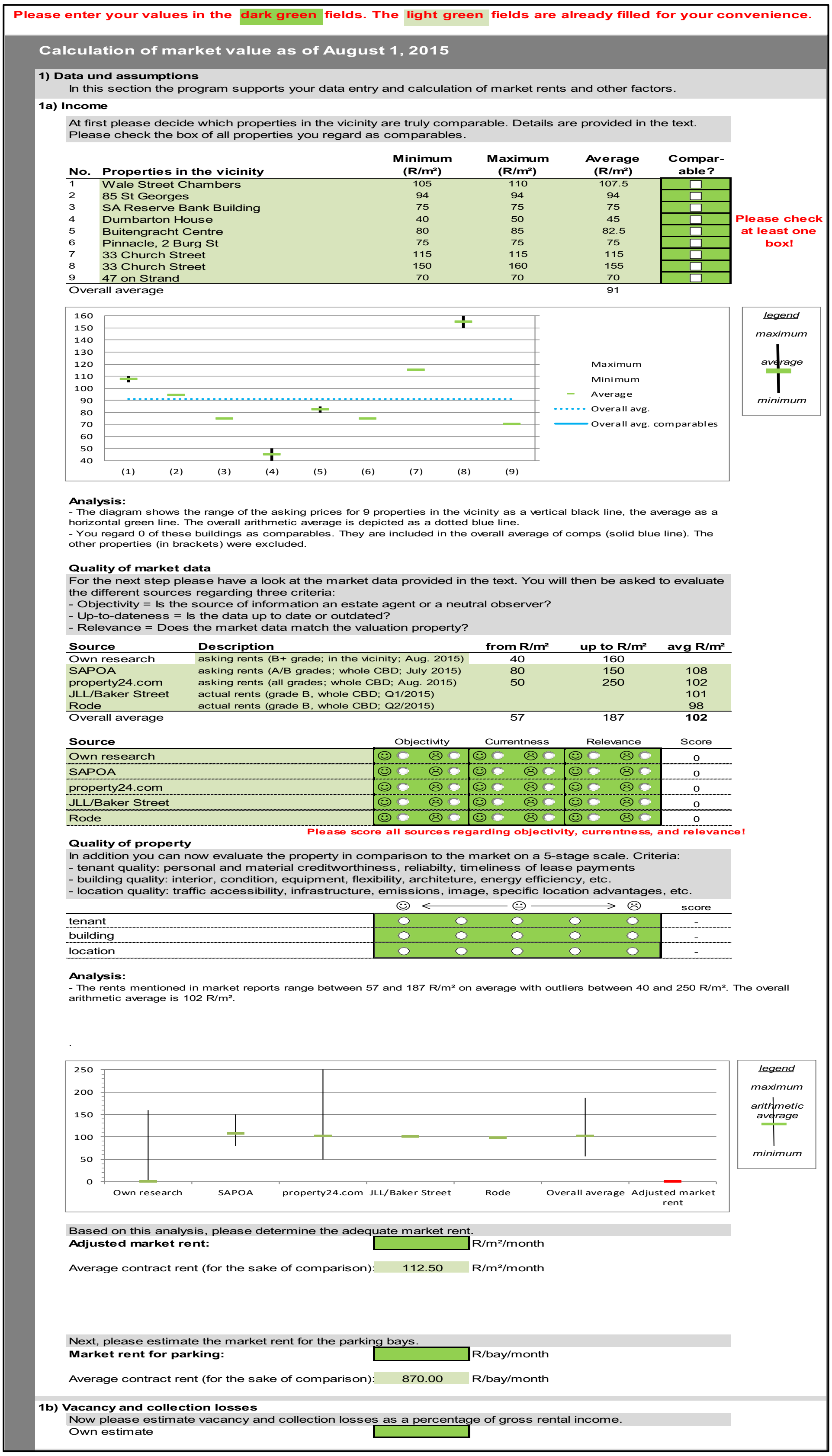
Rates and taxes:		R/year
Insurance:		R/year
Utilities:		R/year
Leasing commissions:		R/year
Maintenance allowance:		R/year
Property management:		R/year

Calculation (Income Approach)

Potential Gross Income			**R 0**
Rental income (offices):	0.00 * 1,368 * 12 =	0	
Other income (parking lots):	0.00 * 10 * 12 =	0	
		0	
- Vacancy and Collection Losses	% * 0 =		**R 0**
= Effective Gross Income			**R 0**
- Operating Expenses			**R 0**
Rates and taxes:		0	
Insurance:		0	
Utilities:		0	
Leasing commissions:		0	
Maintenance allowance:		0	
Property management:		0	
		0	
= Net Operating Income			**R 0**
÷ Capitalization Rate	0.00 %		
= Provisional Market Value			**R 0**
+/- Adjustments			**R 0**
= Market Value			**R 0**

When you have filled in all the data and if you are satisfied with the result of the calculation please click on "End" to finish the valuation.

Appendix D – Second page for Decision Support (DSS) Programme Only



Please enter your values in the dark green fields. The light green fields are already filled for your convenience.

Calculation of market value as of August 1, 2015

1) Data und assumptions
In this section the program supports your data entry and calculation of market rents and other factors.

1a) Income

At first please decide which properties in the vicinity are truly comparable. Details are provided in the text.
Please check the box of all properties you regard as comparables.

No.	Properties in the vicinity	Minimum (R/m²)	Maximum (R/m²)	Average (R/m²)	Compar-able?
1	Wale Street Chambers	105	110	107.5	☐
2	85 St Georges	94	94	94	☐
3	SA Reserve Bank Building	75	75	75	☐
4	Dumbarton House	40	50	45	☐
5	Buitengracht Centre	80	85	82.5	☐
6	Pinnacle, 2 Burg St	75	75	75	☐
7	33 Church Street	115	115	115	☐
8	33 Church Street	150	160	155	☐
9	47 on Strand	70	70	70	☐
Overall average				91	

Please check at least one box!

Analysis:
- The diagram shows the range of the asking prices for 9 properties in the vicinity as a vertical black line, the average as a horizontal green line. The overall arithmetic average is depicted as a dotted blue line.
- You regard 0 of these buildings as comparables. They are included in the overall average of comps (solid blue line). The other properties (in brackets) were excluded.

Quality of market data
For the next step please have a look at the market data provided in the text. You will then be asked to evaluate the different sources regarding three criteria:
- Objectivity = Is the source of information an estate agent or a neutral observer?
- Up-to-dateness = Is the data up to date or outdated?
- Relevance = Does the market data match the valuation property?

Source	Description	from R/m²	up to R/m²	avg R/m²
Own research	asking rents (B+ grade; in the vicinity; Aug. 2015)	40	160	
SAPOA	asking rents (A/B grades; whole CBD; July 2015)	80	150	108
property24.com	asking rents (all grades; whole CBD; Aug. 2015)	50	250	102
JLL/Baker Street	actual rents (grade B, whole CBD; Q1/2015)			101
Rode	actual rents (grade B, whole CBD; Q2/2015)			98
Overall average		57	187	**102**

Source	Objectivity	Currentness	Relevance	Score
Own research	☺ ○ ☹ ○	☺ ○ ☹ ○	☺ ○ ☹ ○	0
SAPOA	☺ ○ ☹ ○	☺ ○ ☹ ○	☺ ○ ☹ ○	0
property24.com	☺ ○ ☹ ○	☺ ○ ☹ ○	☺ ○ ☹ ○	0
JLL/Baker Street	☺ ○ ☹ ○	☺ ○ ☹ ○	☺ ○ ☹ ○	0
Rode	☺ ○ ☹ ○	☺ ○ ☹ ○	☺ ○ ☹ ○	0

Please score all sources regarding objectivity, currentness, and relevance!

Quality of property
In addition you can now evaluate the property in comparison to the market on a 5-stage scale. Criteria:
- tenant quality: personal and material creditworthiness, reliabilty, timeliness of lease payments
- building quality: interior, condition, equipment, flexibility, architeture, energy efficiency, etc.
- location quality: traffic accessibility, infrastructure, emissions, image, specific location advantages, etc.

	☺ ← ☺ → ☹	score
tenant	○ ○ ○ ○ ○	-
building	○ ○ ○ ○ ○	-
location	○ ○ ○ ○ ○	-

Analysis:
- The rents mentioned in market reports range between 57 and 187 R/m² on average with outliers between 40 and 250 R/m². The overall arithmetic average is 102 R/m².

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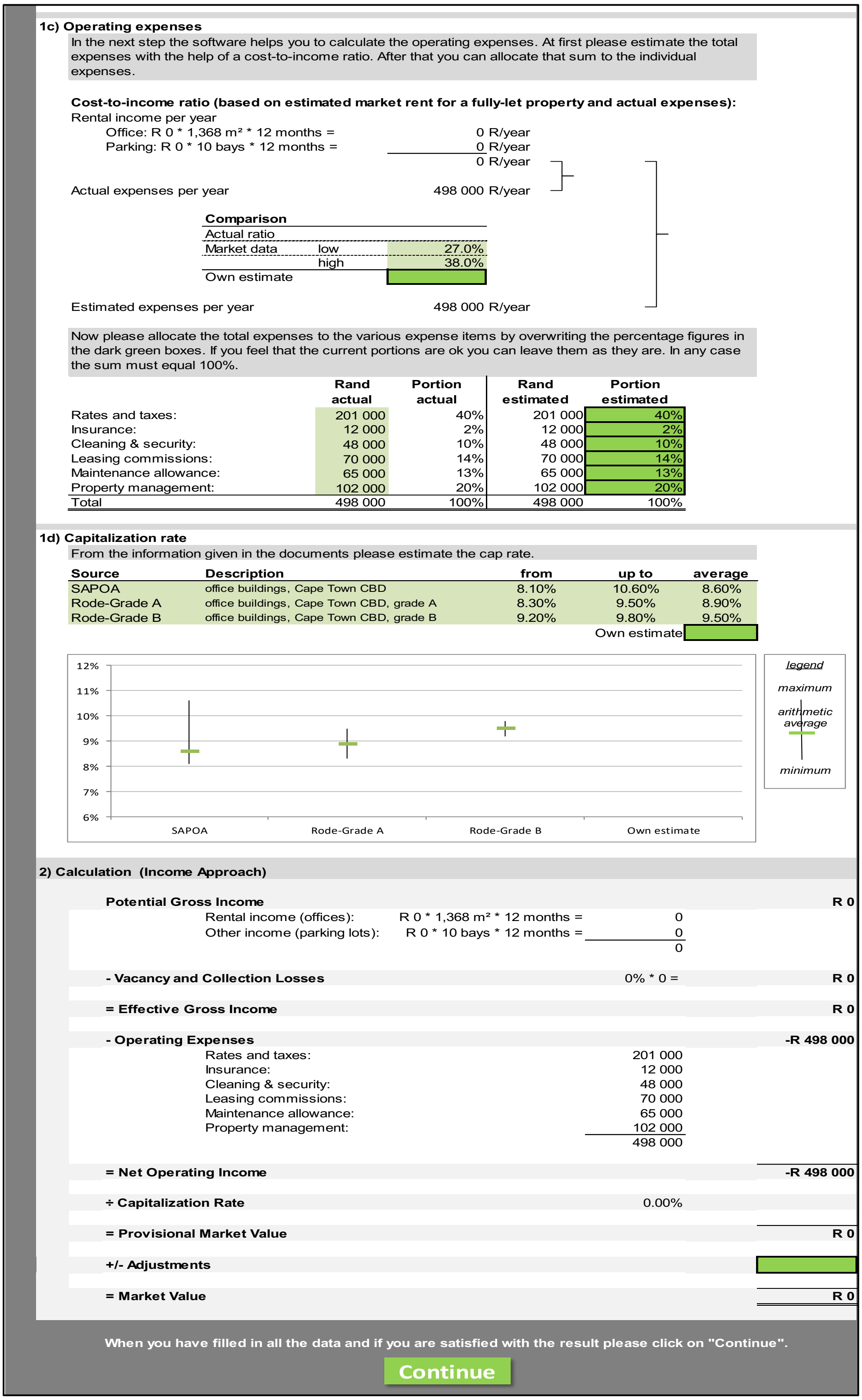
Based on this analysis, please determine the adequate market rent.
Adjusted market rent: R/m²/month

Average contract rent (for the sake of comparison): 112.50 R/m²/month

Next, please estimate the market rent for the parking bays.
Market rent for parking: R/bay/month

Average contract rent (for the sake of comparison): 870.00 R/bay/month

1b) Vacancy and collection losses
Now please estimate vacancy and collection losses as a percentage of gross rental income.
Own estimate



1c) Operating expenses

In the next step the software helps you to calculate the operating expenses. At first please estimate the total expenses with the help of a cost-to-income ratio. After that you can allocate that sum to the individual expenses.

Cost-to-income ratio (based on estimated market rent for a fully-let property and actual expenses):

Rental income per year
Office: R 0 * 1,368 m^2 * 12 months = 0 R/year
Parking: R 0 * 10 bays * 12 months = 0 R/year
0 R/year

Actual expenses per year 498 000 R/year

Comparison		
Actual ratio		
Market data	low	27.0%
	high	38.0%
Own estimate		🟩

Estimated expenses per year 498 000 R/year

Now please allocate the total expenses to the various expense items by overwriting the percentage figures in the dark green boxes. If you feel that the current portions are ok you can leave them as they are. In any case the sum must equal 100%.

	Rand actual	Portion actual	Rand estimated	Portion estimated
Rates and taxes:	201 000	40%	201 000	40%
Insurance:	12 000	2%	12 000	2%
Cleaning & security:	48 000	10%	48 000	10%
Leasing commissions:	70 000	14%	70 000	14%
Maintenance allowance:	65 000	13%	65 000	13%
Property management:	102 000	20%	102 000	20%
Total	498 000	100%	498 000	100%

1d) Capitalization rate

From the information given in the documents please estimate the cap rate.

Source	Description	from	up to	average
SAPOA	office buildings, Cape Town CBD	8.10%	10.60%	8.60%
Rode-Grade A	office buildings, Cape Town CBD, grade A	8.30%	9.50%	8.90%
Rode-Grade B	office buildings, Cape Town CBD, grade B	9.20%	9.80%	9.50%
			Own estimate	🟩

2) Calculation (Income Approach)

Potential Gross Income R 0
Rental income (offices): R 0 * 1,368 m^2 * 12 months = 0
Other income (parking lots): R 0 * 10 bays * 12 months = 0
0

- Vacancy and Collection Losses 0% * 0 = R 0

= Effective Gross Income R 0

- Operating Expenses -R 498 000
Rates and taxes: 201 000
Insurance: 12 000
Cleaning & security: 48 000
Leasing commissions: 70 000
Maintenance allowance: 65 000
Property management: 102 000
498 000

= Net Operating Income -R 498 000

÷ Capitalization Rate 0.00%

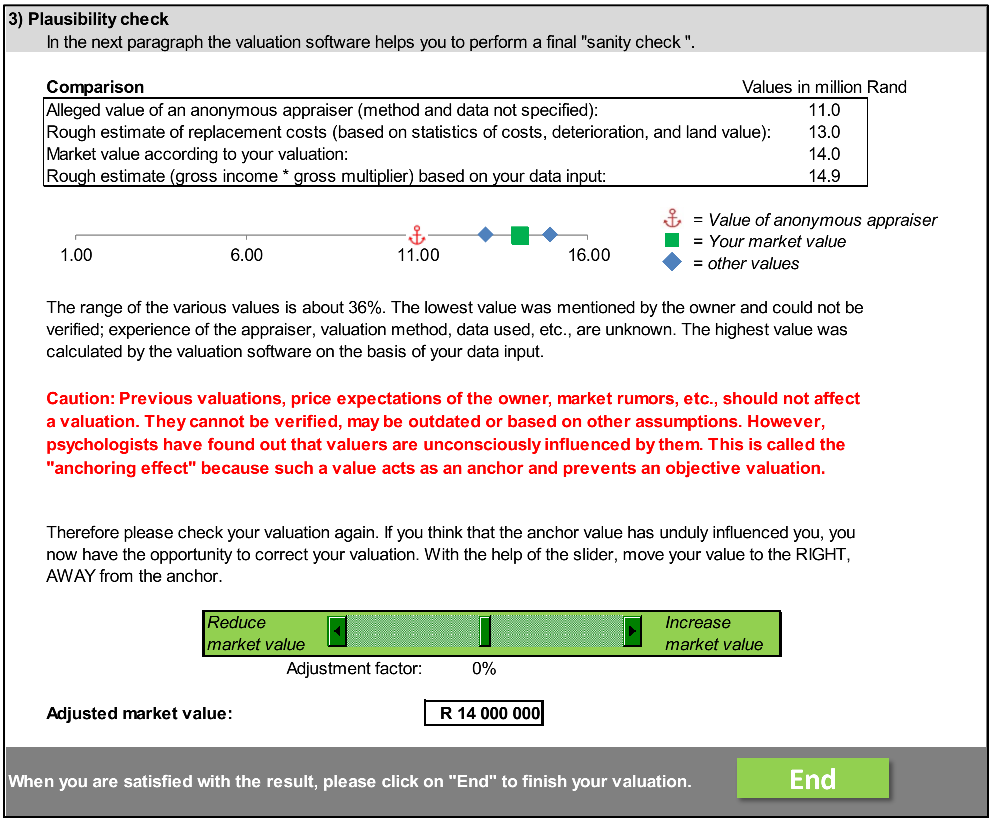
= Provisional Market Value R 0

+/- Adjustments 🟩

= Market Value R 0

When you have filled in all the data and if you are satisfied with the result please click on "Continue".

Continue



3) Plausibility check

In the next paragraph the valuation software helps you to perform a final "sanity check ".

Comparison

	Values in million Rand
Alleged value of an anonymous appraiser (method and data not specified):	11.0
Rough estimate of replacement costs (based on statistics of costs, deterioration, and land value):	13.0
Market value according to your valuation:	14.0
Rough estimate (gross income * gross multiplier) based on your data input:	14.9

The range of the various values is about 36%. The lowest value was mentioned by the owner and could not be verified; experience of the appraiser, valuation method, data used, etc., are unknown. The highest value was calculated by the valuation software on the basis of your data input.

Caution: Previous valuations, price expectations of the owner, market rumors, etc., should not affect a valuation. They cannot be verified, may be outdated or based on other assumptions. However, psychologists have found out that valuers are unconsciously influenced by them. This is called the "anchoring effect" because such a value acts as an anchor and prevents an objective valuation.

Therefore please check your valuation again. If you think that the anchor value has unduly influenced you, you now have the opportunity to correct your valuation. With the help of the slider, move your value to the RIGHT, AWAY from the anchor.

Adjustment factor: 0%

Adjusted market value: **R 14 000 000**

When you are satisfied with the result, please click on "End" to finish your valuation.