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Dept. of Real Estate Management
Div. of Building and Real Estate Economics

Master of Science Thesis no. 97

Real Estate Discounted Cash Flow Model Development and Design

- The process of developing a new DCF model at a multinational real estate consultancy

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Master of Science thesis

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Abstract

Due to increasing skill and awareness of overall functions in programs such as Excel, an increasing number of analysts at real estate firms and consultancies have started developing "desktop" versions of valuation models used for professional appraisal of property value. Due to personal preferences, differences in schools and professional backgrounds, these so called desktop models vary in quality, robustness, accuracy, design and user friendliness. Professional software suites are not suitable either, as they are expensive, hard to learn, hard to adapt to specific needs of the business, outdated design and need of additional IT resources.

At a multinational Real Estate consultancy such as Jones Lang LaSalle, requirements on tools used for professional opinions on questions as important as property value, are rigorous. Therefore, decision was made to develop a new DCF model which would be closely monitored by management and have a prismatic approach meaning that the model would satisfy the needs of more than one division at Jones Lang LaSalle. When reviewing existing models and practices at the company, the result became a tailored DCF valuation model that was focused on increasing efficiency of appraisers at Jones Lang LaSalle. Aside from being robust and technically sophisticated, the result also suited the specific needs of Jones Lang LaSalle in terms of features and user interface. Development of the model involved several divisions to ensure that the needs were met for Research & Valuation, Capital Markets, Corporate Solutions and Asset Management at Jones Lang LaSalle.

Acknowledgement

This Master of Science Thesis has been accomplished at the Division of Real Estate Management at the Royal Institute of Technology in Stockholm, Sweden, during the spring of 2011.

We would like to acknowledge our supervisor Mr. Han-Suck Song for giving us sufficient room to let us find our own path, achieving a superior DCF model for Jones Lang LaSalle. This task would have been impossible if this freedom was not granted by him, as very little material was available for evaluation along the way.

We would also like to thank Mrs. Åsa Linder, head of Research & Valuation at Jones Lang LaSalle. Without her dedication and patience, we would have stranded with this project at the very beginning. Mrs. Åsa Linder had the necessary pedagogic approach with the at times very complex definitions and requirements of high-end valuation practices. Her experience of real estate appraisal laid the foundation for the final product, which has been received better than we could ever expect.

There is no doubt that this exercise will aid us in our coming careers as professionals in the real estate industry.

Ahmed Fetibegovic and Adam Nilsson

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1. Introduction

1.1 Background

Jones Lang LaSalle is one of the largest real estate consultancies both globally and in Sweden with over 40,000 employees worldwide. The company offers a wide range of real estate related services, including valuation. Valuation is a fairly new service in Sweden that was introduced at Jones Lang LaSalle in 2009 and has rapidly grown since then. It started as a side service at the Research department, later to be renamed Research and Valuation as a result of its growth in size and importance for Jones Lang LaSalle in Sweden.

The valuation team at Jones Lang LaSalle is mainly using discounted cash flow calculations when estimating a value of a property. There are various versions of discounted cash flow calculation models in use at the moment, and there is no consensus on which model is preferable from a technically or user experience perspective. This resulted in the need of an overhaul of the current models to develop a universal model that is used and understood by the entire valuation team as well as other employees at Jones Lang LaSalle that is involved in real estate valuations, for instance the Capital Markets department.

1.2 Purpose

Jones Lang LaSalle has expressed that there is a genuine demand for a newly developed model for real estate valuation used by the appraisers. The purpose of this report is to examine the background of the problem, identify the shortcomings of existing and alternative models, and give an overview of how the problem was solved for Jones Lang LaSalle by the introduction of the new discounted cash flow model.

1.3 Scope

The extent of the assignment given by Jones Lang LaSalle is limited to real estate valuation. This includes office, storage, warehouse, logistics, residential, retail and some extent leasehold properties. Simply put, the tool ordered by Jones Lang LaSalle should be able to value any type of income generating real estate property. Limitations to the model include land, corporate and permit valuations, as these usually need a more option based valuation approach.

1.4 Aim

Jones Lang LaSalle has received the model (from now on called “ANVIL”, Appraisal model for Nordic Valuation Intel), which, according to Jones Lang LaSalle, has satisfied the need previously described. This report merely aims at reviewing the process of investigation of what this need really was. Furthermore, this paper aims to review the challenges involved in the process of constructing such a model, the result achieved, and the feedback received by Jones Lang LaSalle.

1.5 Methodology

This report uses a qualitative approach. The main focus is the current situation and needs of the Swedish Research and Valuation team at Jones Lang LaSalle. By studying the existing models and conducting interviews with members of the valuation team, the current valuation model related needs and issues was discovered.

A number of models for real estate discounted cash flow calculation were gathered to study the structure and scope, and further on used in the development process for benchmarking. The authors of this report are involved in the daily operations at the Research and Valuation and the Capital Markets departments, a necessity in order to study and understand the valuation process and current practice at Jones Lang LaSalle.

During the development of the new discounted cash flow model, a number of feedback sessions with stakeholders, such as Åsa Linder (National Director and Head of Research and Valuation) and her colleagues, of the project were scheduled to ensure the quality and scope of the product.

1.6 Quantitative vs. Qualitative approach

Due to the nature of the task given by Jones Lang LaSalle, i.e. developing a new and improved valuation model based upon highly technical and mathematical principles, the study can be claimed to be very quantitative in its nature. This is further enhanced by the fact that the model had to be adequately robust to handle all types of property types combined with all types of tenancies available in Sweden, still providing highly accurate value estimations. On top of that, the model has to be user friendly, i.e. a high level of input process automation through advanced mathematical binominal-like trees that in some cases expanded into a quantity of branches. All of these factors argue that the study is of a quantitative nature, and it is partially correct.

However, the study also relies on important qualitative approach. The end user of the newly developed model is in fact the appraiser, and no model can be perfectly adapted to all end users. Therefore, the majority of time was not put into the technical development of the model (even if that amount of work is in no sense negligible in this case) but rigorous questioning of the appraisers of Jones Lang LaSalle about the flaws in current and competing software. Through these interviews, especially with mrs. Åsa Linder, National Director and Head of Research & Valuation at Jones Lang LaSalle in Sweden, we managed to extract and formulate the core of Jones Lang LaSalle's needs and current issues.

1.7 Validity and reliability

Validity refers to us on account for Jones Lang LaSalle measuring what is relevant in the specific context, while the reliability concerns that we measure in a reliable manner. In our case, validity is much more important than reliability. This is because measuring the right things is core to any valuation. The question about "measuring things right" is much more clearly defined and the industry has very specific definitions of "what is what" in valuation practices, therefore reliability is something that is assumed for any type of valuation tool.

Therefore, emphasis has been put on narrowing down and reduction of uncertainties to the measurements of what is relevant to valuation practices. The validity in this report can be said being able to specify in what situation and for which population the results are valid. The scope of this thesis work is to provide a tool that provides accurate results no matter the situation or appraiser the tool will be used by.

The valuation model presented to Jones Lang LaSalle has been rigorously tested to provide experience-adjusted accurate values, i.e. the result of the model will reflect the level of user experience. This is the main evidence of our reliability being highly accurate, but also the more important aspect of validity being clearly defined and captured in this case. As explained in further detail in the section 8.1, Jones Lang LaSalle appointed a full day workshop for examination of the developed valuation model. In this workshop, it became evident that the validity and reliability of the valuation model was adequately robust to provide accurate values even with highly specific input criteria, input by staff members with low or novice experience of real estate appraisal.

2. Valuation theory

The appraisal process is central in the development of a new discounted cash flow calculation model. One must fully understand the procedure in order to find an efficient and intuitive workflow path in the model as well as what parameters that are input and what parameters are output even though many of them can function as both. For instance, key indicators can be both input and output depending on the path of the process. (Andersson et. al., 2004)

As real estate in general are very complex assets with hundreds or thousands costs involved, every valuation is a simplification of reality. (Damodaran, 2002) The time and resources needed to assess every cost in detail for any given property would be unrealistic and the precision would be diluted due to the forecasting of how those costs develop over time. A simplification of the transactions is a necessity, the question is which of them to simplify and to what extent, hence the need to study the appraisal process.

The layout and hierarchy of the input data is another side of the same coin. What is most preferable in an everyday appraisal process, rent entered per square meter or a total figure? That might depend on the character of the rent figure, be it an actual rental figure for an existing tenant or an estimated rental value (also known as "ERV"). Hence, to achieve a highly efficient valuation tool, each step of the appraisal process must be carefully considered. This applies to both the theoretical real estate valuation framework and the everyday practices of Research and Valuation department of Lones Lang LaSalle.

2.1 The appraisal process

The valuation process may differ from one appraiser to another, but there is an overall systematic procedure that all must follow in order for the valuation to be reliable. The main purpose of the value is to answer the questions of real estate value, in this case assumed to be the clients'. Often it is the question of market value but there are other types of value, for instance investment value or use value which is beyond the scope of this thesis. However, for these different types of real estate value the overall framework is the same. (Andersson et. al., 2004)

The process depends on the nature of the subject property and the data available. The characteristics of the asset affects the range of the different steps involved in the appraisal procedure. Failing to follow these steps would jeopardise the accuracy as well as the understanding of the results that leads to the appraisal conclusions. (Appraisal Institute, 2001)

The appraisal process has its base in knowledge of the market, and the best knowledge comes through thorough research. The first step, however, is to define the problem that is the cause of the need of a valuation and the accompanying scope of work needed to arrive at the conclusions to solve the problem as well as satisfy the needs of the client. When the problem has been defined, relevant data collection can be initiated. (Damodaran, 2002)

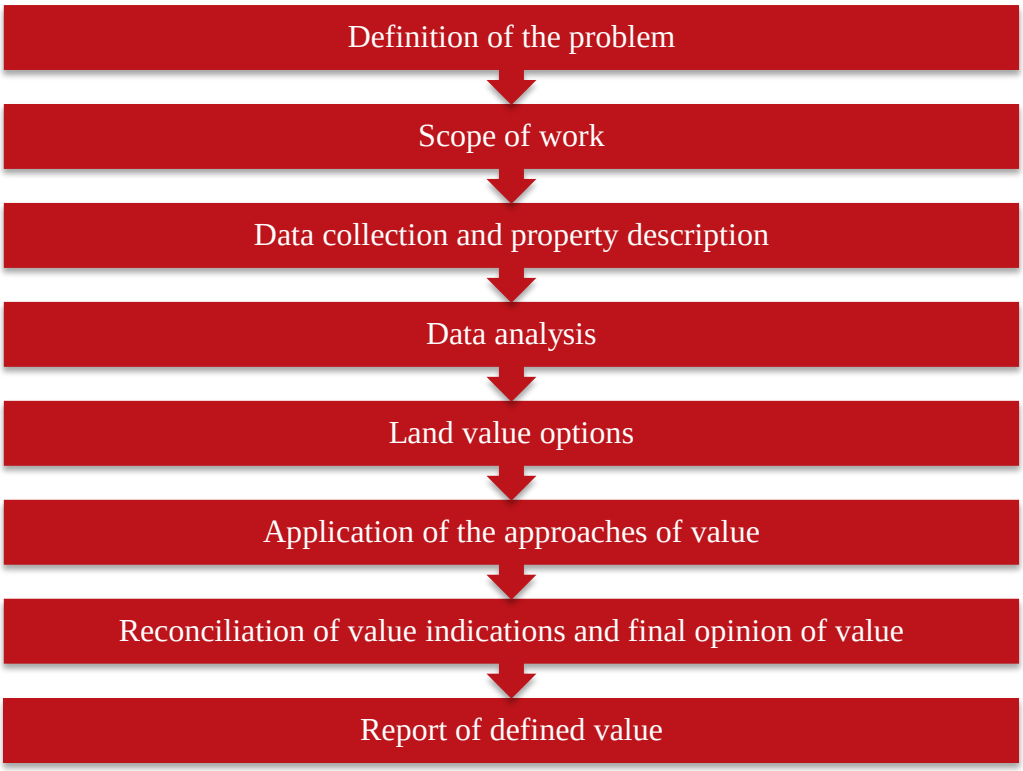


Figure 1. An overview of the appraisal process.

The data needed is both the of the present situation in order to grasp the situation the property is in today and past information in order to detect on going trends in order to make accurate estimations. (Lusht, 2002) This data may be real estate specific data but should also be information about the overall current economic situation that is likely to affect the real estate industry. The real estate industry is highly interlinked with macro-economic variables such as inflation or interest rates, but also regional changes. For instance, a property located in a prospering and aggressively growing submarket could have a very different future development compared to an asset in another submarket in the same city. (Appraisal Institute, 2001)

Data collection also includes legal information such as planned changes in legislation of permits and taxes. The appraiser must be informed about such changes (or market expectations of changes as those are equally valid) that would have an impact value.

In addition, property specific data must be collected. This data includes physical, legal, cost, income and expense attributes that is relevant to the valuation, including financial arrangement that could have an impact on value. The physical state of the property is highly important due to the possibility of neglected maintenance that could offset the cash flow over the holding period and thus the market value. Data on comparable properties must be collected as well to determine the supply and demand state of the market that the subject property is located in. (Lusht, 2002)

When sufficient data is collected the data is examined and analysed. The analysis has two components, market analysis and highest and best use analysis. The market analysis is a study of the market conditions and the highest and best analysis is a consideration of the value of the land as vacant and the property as improved. The conclusion of the highest and best use is a specification of the lands optimal use for maximised value. Land value option is directly related to the highest and best use analysis, the question of however the use of the land is best with the current situation or if the value would increase if the land is converted into another use. In many cases the value of the land must be separated from the value of the property as those two values may evolve different over time. (Appraisal Institute, 2001)

Following the data analysis application of the approaches of value is done. The three main approaches of value are cost, sales comparison and income capitalization. (Andersson et. al., 2004) The method performed at Jones Lang LaSalle, and thus the focus of this report, is the income capitalization approach through DCF analysis combined with the sales comparison approach. The income of the property subject to a value appraisal is capitalized though for instance yields derived through comparable sales. DCF and comparable sales are further described in the section 2.2 and 2.3 respectively.

The appraisal process is finished when the appraiser performs a final reconciliation of value indicators and a report is created where the estimated value is formulated along with the arguments that are the foundation of the process defining the quoted value. (Lusht, 2002)

2.2 Discounted Cash Flow analysis

Real estate that is considered as income producing is usually an investment. From the investors' perspective, the income potential is the most important aspect for determination of Real estate value. The most basic rule of investments is that the higher the earnings, the higher value, as long as risk is kept at the same level. Simply put, an investor who purchases

real estate is trading present currency for an expected amount of currency in the future. (Andersson et. al., 2004)

More formally put, in the cash flow and income capitalization approach, the analysis is mainly focused on the property's capacity to generate future benefits and capitalizes the income into an indication of present value. The principle of anticipation is fundamental to the approach. Techniques and procedures from this approach are used to analyze comparable sales data and to measure obsolescence is the cost approach which is explained in the next chapter. (Appraisal Institute, 2001)

For any types of patterns of regular or irregular income to a property, discounted cash flow (DCF) is considered the most relevant and appropriate method by most modern researchers. (Damodaran, 2002) DCF analysis also most preferred in most modern real estate valuation companies. Basic models in excel built with relatively low level of mathematical skill can be constructed in a short matter of time, which has led to an over-supply of DCF-models that all vary in quality and accuracy. Many of these models are to be found in most companies doing real estate valuations, as they are a practical tool for everyday valuation practices. (Damodaran, 2002)

The core of the discounted cash flow analysis is to calculate the net present value of expected future income. This is mainly the net operating income of each year within the cash flow period and the residual value at the end of the period. The formula can be illustrated as below.

$$DPV = \sum_{t=1}^{N} \frac{FV_t}{(1+i)^n}$$

Where *DPV* is the discounted present value of all the future cash flow amount (*FV*) at any time period (*t*) with an interest rate (*i*). (Lusht, 2002)

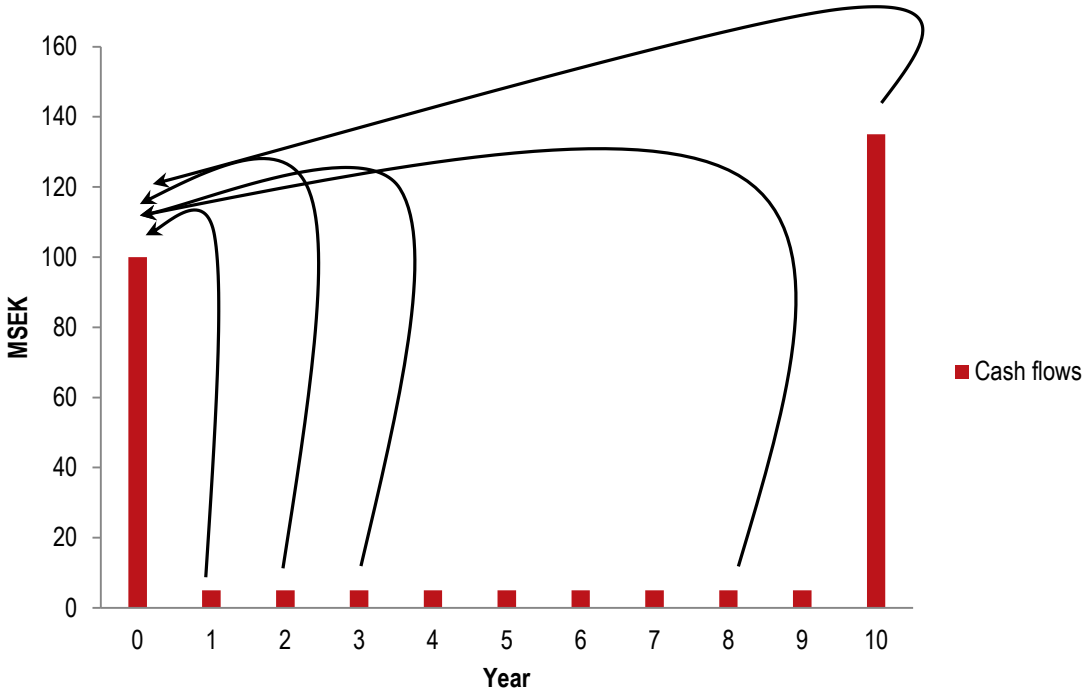


Figure 2. Illustration of the two major components in real estate market value in a discounted cash flow analysis; the present value of net operating income and exit price.

Simply put, the market value in a discounted cash flow analysis consists of the present value of expected cash flows. The holding period can be any number of years, usually between five and twenty years. Less than five years defeats the purpose of a cash flow analysis as the analysis becomes more like a direct capitalisation approach where the exit yield has a substantial impact on the value. Therefore, a lot of emphasis is put on simply estimate the exit yield as the main value driver. (Andersson et. al., 2004)

Likewise, a very long holding period would mean a strong emphasis on the rent and cost development. The longer the holding period is, the harder it becomes to forecast the parameters that drives value. The exit yield will naturally be one of the hardest components to estimate, as the yield would be a forecast of the market conditions a long time from the valuation date. Thus, the length of the holding period should be a compromise between specific property aspects and the ability to forecast market changes. (Appraisal Institute, 2001)

2.2.1 Applicability of DCF

Discounted cash flow analysis can be used to both estimate present value and to extract a yield rate from a comparable sale. Generally, DCF analysis is used to solve for present value given the rate of return or for the rate of return given the purchase price. In typical appraisal

work, the appraiser begins by developing detailed spreadsheets with computer software such as Microsoft Excel. These spreadsheets show itemized incomes, expenses and cash flows in and out of the real property interest being appraised and estimate the timing of these cash flows so that the time value of money is properly recognized in the analysis (Damodaran, 2002).

Critics point out that projections not warranted by market evidence can result in unsupported market values and that the results of the analysis can be subtly affected by minor leaning (Lusht, 2002). These problems reflect misuse by individual appraisers, it is not a flaw in the technique's soundness. Other critics object to the uncertainty of forecasting financial results five or ten years into the future and cite this as a reason for not using or relying of the DCF technique (Lind, 2003). However, this argument ignores the reality of the real estate marketplace. Investors do make forecasts and rely on DCF analysis, particularly in regard to investment-grade, multitenant properties such as shopping centres and office buildings. In keeping with the principle of anticipation, market-supported forecasting is the essence of valuation. Hence, it must be approached in the same way that all market data extractions are accomplished – i.e. with diligent research and careful verification. (Appraisal Institute, 2001)

Discounted cash flow analysis can only provide accurate results if the forecasts developed are based on accurate, reliable information. Rather than attempting to forecast peaks and falls over a holding period, a level of precision that is virtually impossible to achieve, appraisers reflect market expectations as to how the subject property will perform over time (Lusht, 2002).

2.3 Comparable sales analysis

The comparable sales approach is based on the assumption that the price of the subject property can be compared to the sales of similar properties previously sold. That conclusion can be based on two basic assumptions – that the market price is acceptable evidence of market value, and that comparable bundles of property rights will sell for comparable prices (Lusht, 2002).

In economic theory, these assumptions are often referred to as the "law of one price" and in appraisal theory it is referred to as "the principle of substitution". The problem is that neither of these two assumptions work perfectly in any real estate market, however, they work well enough and often enough to justify the use of them. This is true only if there is enough data on sales in the subject market.

Comparable sales can be split further into three categories, the direct sales approach, the direct sales comparison using statistical inference and the sales comparison using regression analysis. These three have different strengths and weaknesses. The direct sales comparison requires only a small sample of comparable sales, where the valuation is highly dependent on the good judgment of the appraiser (which is likely why this method is by far the most popular and commonly used) (Lusht, 2002).

The direct sales comparison using statistical inference requires a much larger sample of comparable sales. This method is considered a bit more objective than the direct sales approach, and it also enables the use of a mathematically calculated confidence interval which makes this method increasingly popular among modern appraisers (Råckle & Waxler, 2005).

The sales comparison using regression analysis approach is the method that needs the by far largest set of data to be executed in a proper way. The approach is advantageous to use when valuating very large sets of properties, like for instance taxation purposes in a country or valuation of assets where the comparable data is large in quantity but where the data of each asset has low transparency. (Appraisal Institute, 2001)

3. Existing valuation models

Valuations are done on a daily basis. While they are highly regarded, professional valuations, the tools used vary between clients and individual appraisers. As previously stated, it is preferable to agree upon one universal discounted cash flow model to be used in the firm for various reasons.

3.1 In-use models within Jones Lang LaSalle

There are a couple of models in use that vary in complexity and quality, however, none satisfies the needs expressed by the Research and Valuation department at Jones Lang LaSalle.

There is a trade off in efficiency between the level of complexity and user friendliness; a technically sophisticated easily gets unintuitive and time consuming to understand and use (interview Linder, May 4 2011). For example, there is a model supplied by a client[1] that is so complex and cumbersome to work with that the majority of time is spent on data administration and entering instead of the analysis that is adding value to the client. A lot of time is spent on merely learning and trying to understand the model, as the responsibility lies with the appraiser that the output is correct. Nonetheless, very simple models are often lacking in features resulting in a lot of extra work modifying the model.

To modify an existing model to completely suit the present need of Jones Lang LaSalle is not feasible. It would require complete reengineering of the model and without the original designer still employed, there is a risk of possible intrinsic errors being left in or created in the process. It is simply too time consuming compared to building a new one.

3.2 Commercial software suites

There are various software suites available that can provide a professional appraiser with discounted cash flow analyses, for instance Argus Software. The advantages are that they are reliable in the sense that the algorithms that the calculations are based on are correct and robust, and if there is a problem there is user support for the product.

The disadvantages are, however, severe. Merely the cost of such software solution may eliminate it as a candidate as they normally costs several thousand dollars or more. On top of this comes additional fees for multiple user licences. The workstations are continuously

[1] Due to confidentiality agreements, specific client information cannot be exposed.

replaced as they get old and brakes, and the installation of additional software is a costly and cumbersome process as user lack administrator privileges due to rigorous IT policies.

The advantages of an in house model automatically becomes disadvantages for commercial software suits. Even though there might be readily available graphs and output sheet included in the software, they are known to be aesthetically unappealing. In addition, there are very limited options in terms of customizing the graphs and output sheets to make them comply with the company's graphic identity.

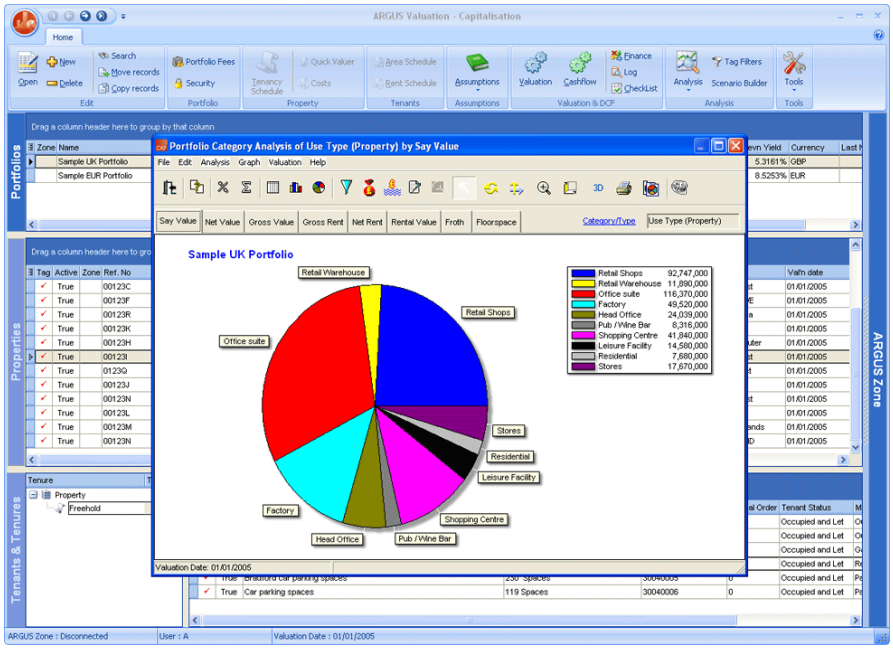


Figure 3. Screen shot of an example of external DCF software, Argus Valuation.

The value of a good user experience should not be overlooked. For instance, the transition from Office 2003 to Office 2007/2010 was significantly worse than expected at Jones Lang LaSalle. Forcing users to adapt to a new interface costs time and energy, and thus money. The peak of efficiency is not reached until the user is comfortable and used to the user interface. A new interface may add value but the consequences of adding an additional interface must be carefully considered. Therefore, using a model that operates in a familiar interface is preferable holding everything else equal.

In short, external discounted cash flow calculation software has the disadvantage of not having the interface of Microsoft Excel. Excel has two very fundamental advantages in this context; It is very sophisticated when managing graphs and tables and employees are familiar with the interface in general.

Adding to this, manual changes and exceptions are not easily inserted compared to the Excel based equivalent. With some knowledge of the features in Microsoft Excel, a model is easily reengineered to suit specific conditions of a property for valuation purposes.

To summarise, there are enough shortcomings of external software suits to dismiss them. Thus, henceforth software suits are regarded as unsuitable for valuation purposes at Jones Lang LaSalle, given the available options.

4. Specific needs of Jones Lang LaSalle

The specific needs of Jones Lang LaSalle are one of the main reasons for the initiative of the development of a new real estate discounted cash flow calculation model. There are a couple of main areas where existing valuation models were underperforming.

4.1 Specific valuation practices

As the Jones Lang LaSalle's Research and Valuation department in Sweden is a group of individuals, the individual valuation practice needs to be considered during the development of the new real estate discounted cash flow calculation model called ANVIL (Appraisal model for Nordic Valuation Intel). Specific valuation practices incorporate technical aspects as well as user interface.

While technical aspects may not fundamentally differ from common valuation practice in the industry, the level of complexity and detail in terms of assumptions and data entering. For instance, the holding period is customizable in the model with a resolution of one year from one to twenty years, something that is usually fixed to only five or ten years. Furthermore, default attributes such as structural vacancy must be alterable in an accessible way.

Vacancies is a problematic area. One of the specific requests from Åsa Linder was the ability to adjust the effective vacancy rates (income losses) per year and per premises type. This is due to the cumbersome procedure to adjust vacancy rate per tenant and per year of there a large number of tenants in the subject property.

The user interface is, of course, a question of subjective taste. Fonts, colours and layout must comply with user expectations (when not bound by company policy). Before the introduction of ANVIL there were no such model that was aesthetically pleasing and graphically branded by the Jones Lang LaSalle colour palette and font family.

4.2 Branding

Jones Lang LaSalle has a strict, global brand identity policy. This is relevant as graphs and tables produced by the cash flow model must comply with the policy. For increased efficiency, the user should have readily available graphs and tables with the necessary information for direct insertion into the client report without the need to change the scope or presentation of the information.

4.3 Company-wide

As previously mentioned, Research and Valuation is not the only department involved in real estate appraisal. The Capital Markets team regularly performs real estate appraisals due to the necessity to estimate a value of the asset as a part of a real estate transaction advisory service. Having a common discounted cash flow model can be helpful to the internal encouragement to collaborate between departments in order to facilitate efficiency and cross selling, hence the need for the Capital Markets team to provide feedback in the development of the new model.

4.4 Enhanced features for increased efficiency

The valuation team at Jones Lang LaSalle produces a large quantity of valuation reports every year. Along with every report comes a set of graphs and tables, and because the absence of a standardised model with readily available graphs they have to be done manually for every new report written. Consequently, having automatically generated graphs was a priority from an efficiency perspective during the development of the new discounted cash flow model. More on the development of automated graphs and tables in the section 5. Development of the new valuation model.

5. Development of a new valuation model

The development of the new real estate discounted cash flow model started with a blank excel document. There were a number of reference models available that could have functioned as templates, but since none of them met the requirements of Jones Lang LaSalle in terms of features and user interface the decision was made to start from scratch.

5.1 Technical challenges

A notable phase in the development of the model was the design of the formula that calculates the rent at a given time depending on dates entered by the user. The user enters the current rent and dates for lease start and end eventually followed by a void period prior to a second lease at estimated market rent (also known as ERV, estimated rental value). The model then automatically determines how much and when rental income occurs. As a result, a couple of criteria must be fulfilled in the formula before rental income is relevant. If fulfilled, the level of income is dependent on rental growth (often anchored to inflation).

The core of the formula is a set of "IF" commands, each consisting of a logical test and values for if the test is true or false.

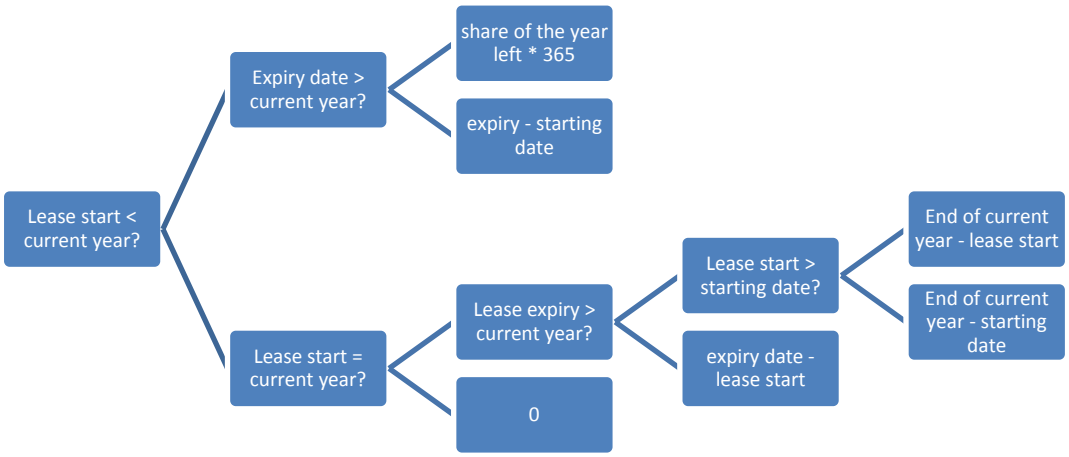


Figure 4. Illustration of the formula that controls rental income per year and tenant.

Figure 4 is a tree like illustration of the part of the formula controlling the number of days of rental income for year one (thereof the share of the year left ratio expression). After each question, or IF command to be exact, a value or an additional question is activated depending on the result of the logical test. The end result is multiplied by the rent including possible

index adjustment. This structure is used for rental, tax and service charge calculation per year and per tenant. Years other than the first have the share of the year left expression replaced by the days of a full year.

This is a mere example of the technical level of the DCF model in the actual excel sheet. This particular problem was chosen because its suitability for illustration.

5.2 User interface

A DCF model can be confusing and difficult to grasp at first sight, and colour coded cells is an effective approach to make the model more intuitive. The user can quickly identify where the cells are that require user input and the cells that include formulas and do not rely on direct input. Colour codes are a common ingredient in DCF models, however, the use of the colour scheme tend to be inconsistent, forcing the user to reverse engineer formulas in order to sure that no important cells for user input are overlooked.

The need for this type of user interface improvements are necessary as there is a large number of cells existing purely for technical purposes (calculating rent accurately for instance). The tenancy schedule sheet include approximately 300 cells for the sole purpose of calculation (no input or direct output) per tenant, resulting in approximately 3000 cells for a building with 10 tenants. As a result, extra attention has been given to this area in the development of the new model.

5.3 Presentation and report automation

Having features in the discounted cash flow model intended for the client report is rational as the information required for graphs and tables is based on the result of model or on the same information entered in the model.

The process of developing graphs is a seemingly simple task given the powerful software suits available today. The problem, however, is to have dynamic graphs that adjusts to the number of years specified in the holding period input cell. That there are no easy way to achieve this was discovered quickly. The problem was eventually solved through the use of “OFFSET” functions and named cells through the name manager feature in excel, as the graph tool would not allow formulas in the data entry field. While this technical issue was a sort of an achievement to overcome by itself, what is important is the value added to the end user. In the end, the new cash flow model was given a feature that the valuation department had not seen in any other model to date.

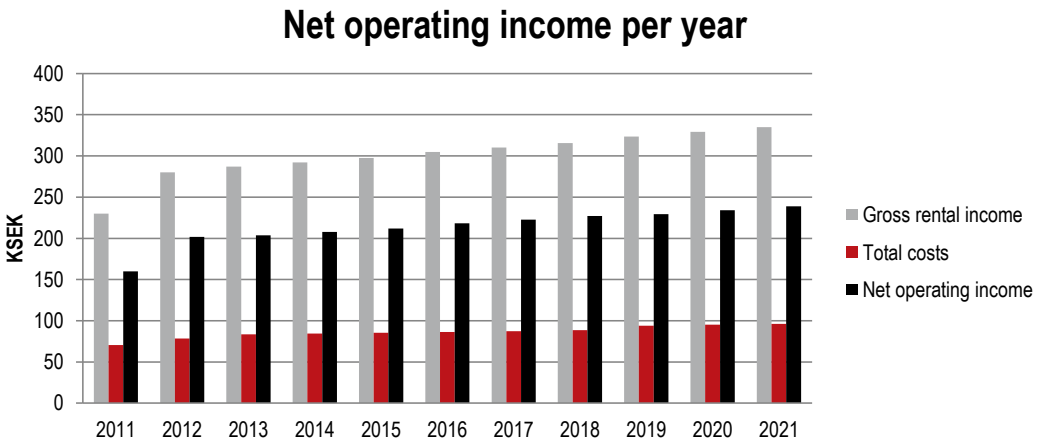


Figure 5. Example of an output graph.

Furthermore, pie charts are frequently used in valuation reports to illustrate for instance the share of area per premises type (office, retail, residential etc) or income per tenant. A similar problem arose in the development of a pie chart that was supposed to only include premises types that is relevant to the subject property. In other words, a property with only office and retail need not to include residential or industrial labels in the pie chart legend. Again, the task was completed through innovative Excel use, using Visual Basic code to hide rows in a table created for the sole purpose of providing the pie chart with only relevant information. While the effort of achieving this may not be noticeable by the end user, the purpose is still valid; providing the user with a hassle free and efficient interface that provides graphs that can be inserted directly in a client report without the need of manual manipulation.

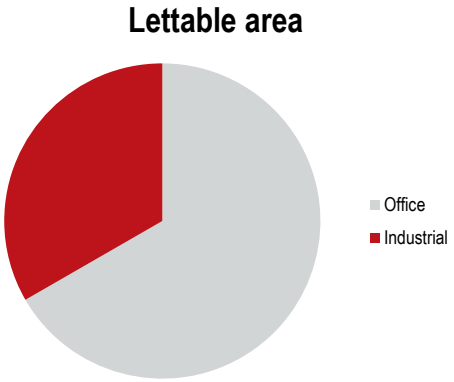


Figure 6. Example of output pie graph.

Client valuation reports normally includes a tenancy schedule table and a cash flow table. The cash flow table is updated automatically when the holding period changes and notifies the user with a dialog window. This function uses a VBA script that activates four separate scripts for each sheet (the cash flow table sheet is one of them) that includes the holding period when

the number of years is changed. By the push of a button the table is copied to the clipboard with exactly the number of rows necessary. The print area is changed as well, ensuring that the table is neatly fitted on one paper sheet.

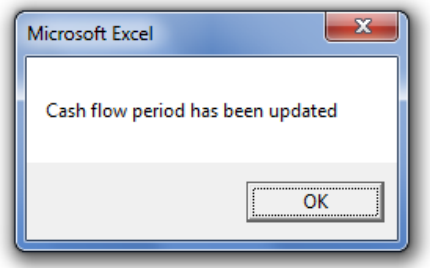


Figure 7. Custom user dialog window.

The amount of the rows in the prepared tenancy table for client reports equals the number of rows in the tenancy schedule input sheet. The user can specify the number of rows (one row per tenant or unit) and afterwards delete existing or add new ones by the push of a customised button. This is also achieved through VBA scripts.

All tables and the majority of graphs (one graph needs to have a button pressed) presenting information relevant to the client report are automatically updated when data is entered into the model. In addition all graphs and tables are formatted to comply with Jones Lang LaSalle´s graphical policy. This includes colours, fonts and size.

6. Final product: ANVIL (Appraisal model for Nordic Valuation Intel)

The resulting model, also known as ANVIL, consists of the following sheets (with dummy information for demonstration purposes):

6.1 Introduction

A welcoming front page sheet where the model is presented with company logo and short descriptions and links to each sheet. A legend describing the colour scheme is included at the bottom.

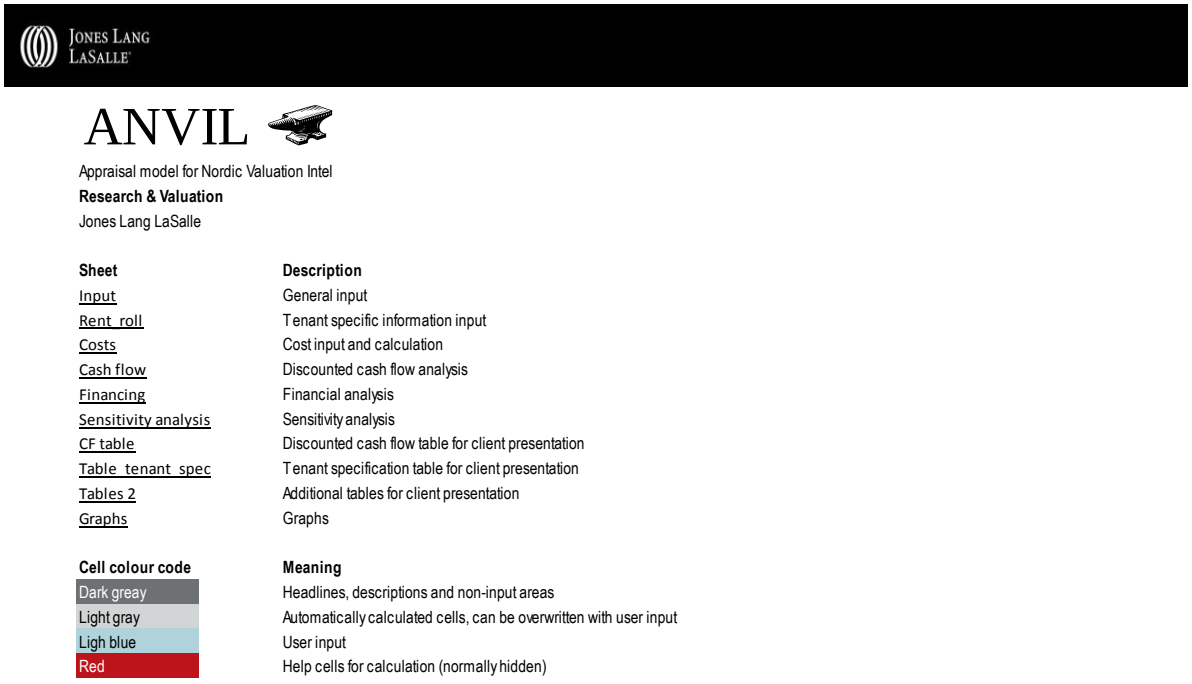


Figure 8. Screen shot of front sheet of ANVIL.

A lot of thought was put into the layout of this sheet in order for the model to be perceived more as a product rather than a mere Excel workbook.

6.2 Input

The input sheet is the appraisers main area for involvement. The input fields are arranged in a logical order, starting with the name and address of the subject property followed by cash flow prerequisites such as valuation date, inflation, cash flow holding period and index base. The valuation date can be specified at a resolution of one day, the model calculates the quota left of the year to include in the cash flow analysis. Further on, the user can specify inflation on a year to year basis. Other important input parameters are assessment values and estimated vacancy risk per year and premises type. The assessment values can be specified to grow with index annually, every third year or every sixth year, due to the Swedish Tax Agency's revision routine.

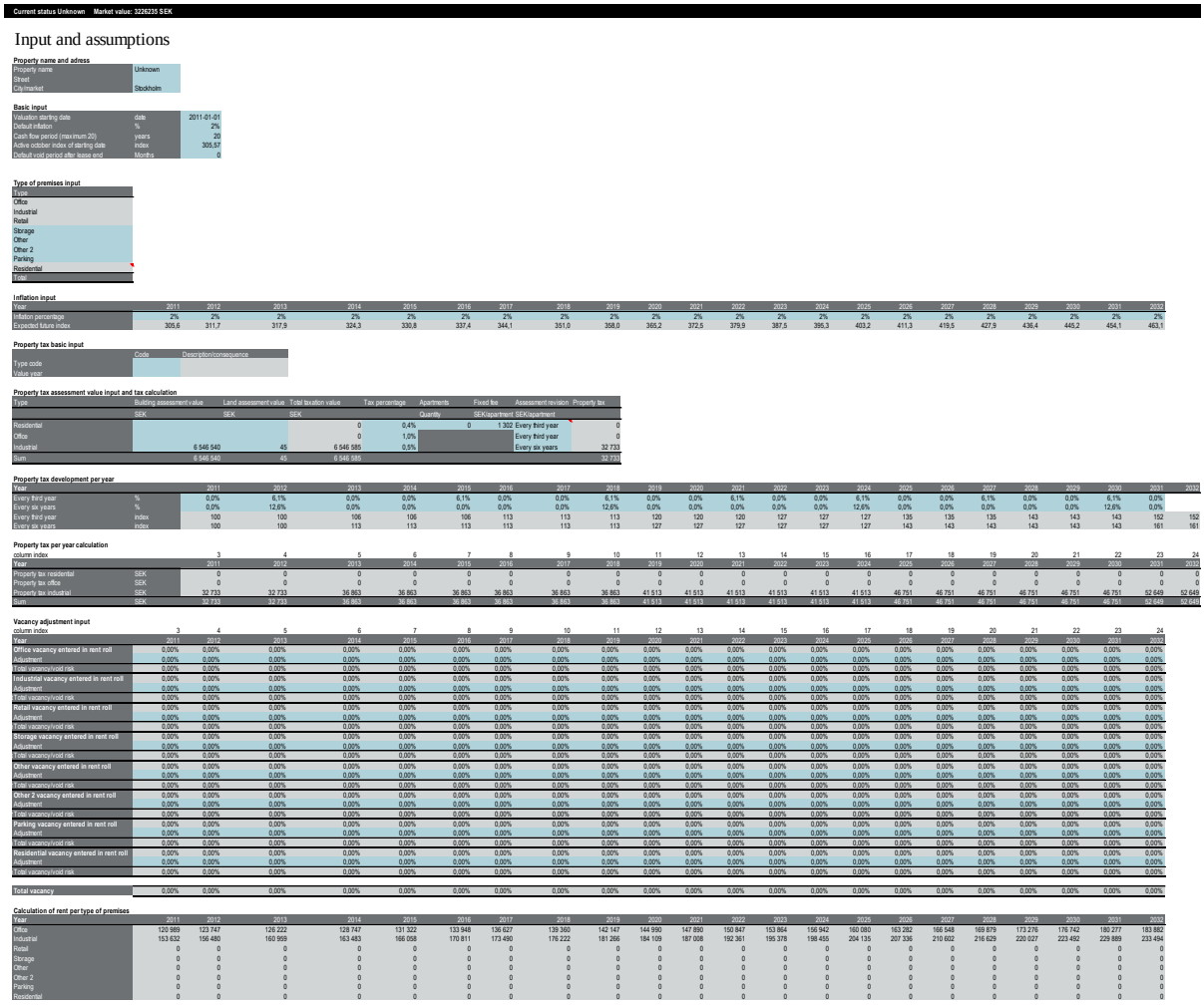
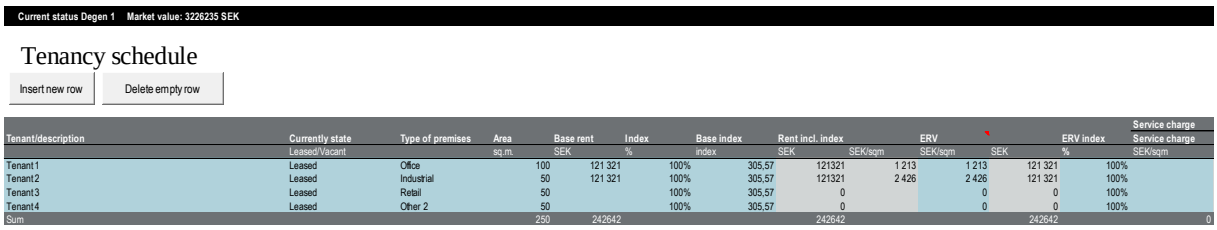


Figure 9. Screen shot of input sheet of ANVIL.

A status row was created in the top of the sheet that is locked (it is visible even though the user would scroll the sheet). This aids the appraiser to instantly see how the value changes when new data is input. The status row is incorporated in several sheets in the model.

6.3 Rent roll

Tenancy schedule input. Tenant specific input such as rents, index adjustments, recoverable costs etc. The user can easily add new rows through pressing the button “Insert new row” and then specify the amount of rows requested. To decrease the number of rows, the procedure is just as simple; The user presses the “Delete empty row” button. The delete button only deletes rows with an empty “Tenant/description” cell, preventing the user from accidentally deleting rows with important information. Each row has a very large number of columns that calculates tenant and year specific information.



Tenant/description	Currently state	Type of premises	Area	Base rent	Index	Base index	Rent incl. index		ERV		ERV index	Service charge
	Leased/Vacant		sq.m.	SEK	%	index	SEK	SEK/sqm	SEK/sqm	SEK	%	SEK/sqm
Tenant 1	Leased	Office	100	121 321	100%	305,57	121321	1 213	1 213	121 321	100%	
Tenant 2	Leased	Industrial	50	121 321	100%	305,57	121321	2 426	2 426	121 321	100%	
Tenant 3	Leased	Retail	50		100%	305,57	0		0	0	100%	
Tenant 4	Leased	Other 2	50		100%	305,57	0		0	0	100%	
Sum			250	242642			242642			242642		0

Figure 10. Screen shot of tenancy schedule of ANVIL.

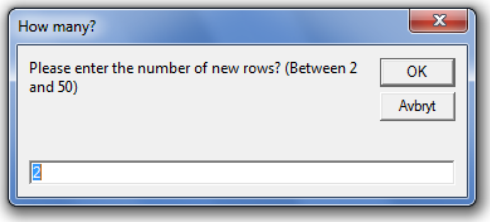
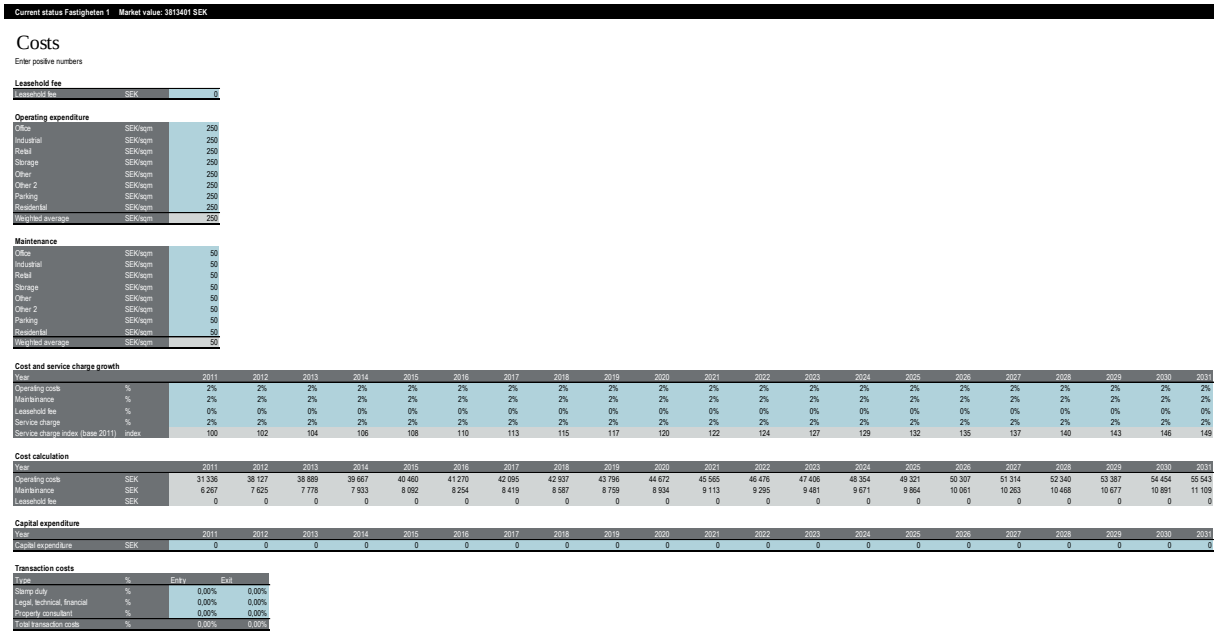


Figure 11. Custom user dialog window. Activated when the "Insert new row" button is pressed.

The decision to not hide this information from the user was made due to the notion that some of the information can be of value for an appraiser that wants to understand the underlying mechanisms of the model. The Research and Valuation team of Jones Lang LaSalle in Sweden were very clear about not wanting a “black box” valuation model that is difficult to grasp from a technical point of view. In addition, hiding too much information could marginalize the appraisers professional role of analysing real estate. A skilled appraiser takes little for granted, and the question of how the model is technically built would inevitably surface when the model is put to use.

6.4 Costs

The cost sheet has input fields for operating expenditure and maintenance and the development of these costs over time. The costs are specified per type of premises and when entered a weighted average is displayed based on the area specified in the tenancy schedule. In addition, the costs are displayed in nominal numbers on a year to year basis.



Current status Fastigheten 1 Market value: 3813401 SEK

Costs

Enter positive numbers

Leasehold fee

Leasehold fee	SEK	0

Operating expenditure

Office	SEK/sqm	250
Industrial	SEK/sqm	250
Retail	SEK/sqm	250
Storage	SEK/sqm	250
Other	SEK/sqm	250
Other 2	SEK/sqm	250
Parking	SEK/sqm	250
Residential	SEK/sqm	250
Weighted average	SEK/sqm	250

Maintenance

Office	SEK/sqm	50
Industrial	SEK/sqm	50
Retail	SEK/sqm	50
Storage	SEK/sqm	50
Other	SEK/sqm	50
Other 2	SEK/sqm	50
Parking	SEK/sqm	50
Residential	SEK/sqm	50
Weighted average	SEK/sqm	50

Cost and service charge growth

Year		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Operating costs	%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Maintenance	%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Leasehold fee	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Service charge	%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Service charge index (base 2011)	index	100	102	104	106	108	110	113	115	117	120	122	124	127	129	132	135	137	140	143	146	149

Cost calculation

Year		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Operating costs	SEK	31 336	38 127	38 889	39 667	40 460	41 270	42 095	42 937	43 796	44 672	45 565	46 476	47 406	48 354	49 321	50 307	51 314	52 340	53 387	54 454	55 543
Maintenance	SEK	6 267	7 625	7 778	7 933	8 092	8 254	8 419	8 587	8 759	8 934	9 113	9 295	9 481	9 671	9 864	10 061	10 263	10 468	10 677	10 891	11 109
Leasehold fee	SEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Capital expenditure

Year		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Capital expenditure	SEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Transaction costs

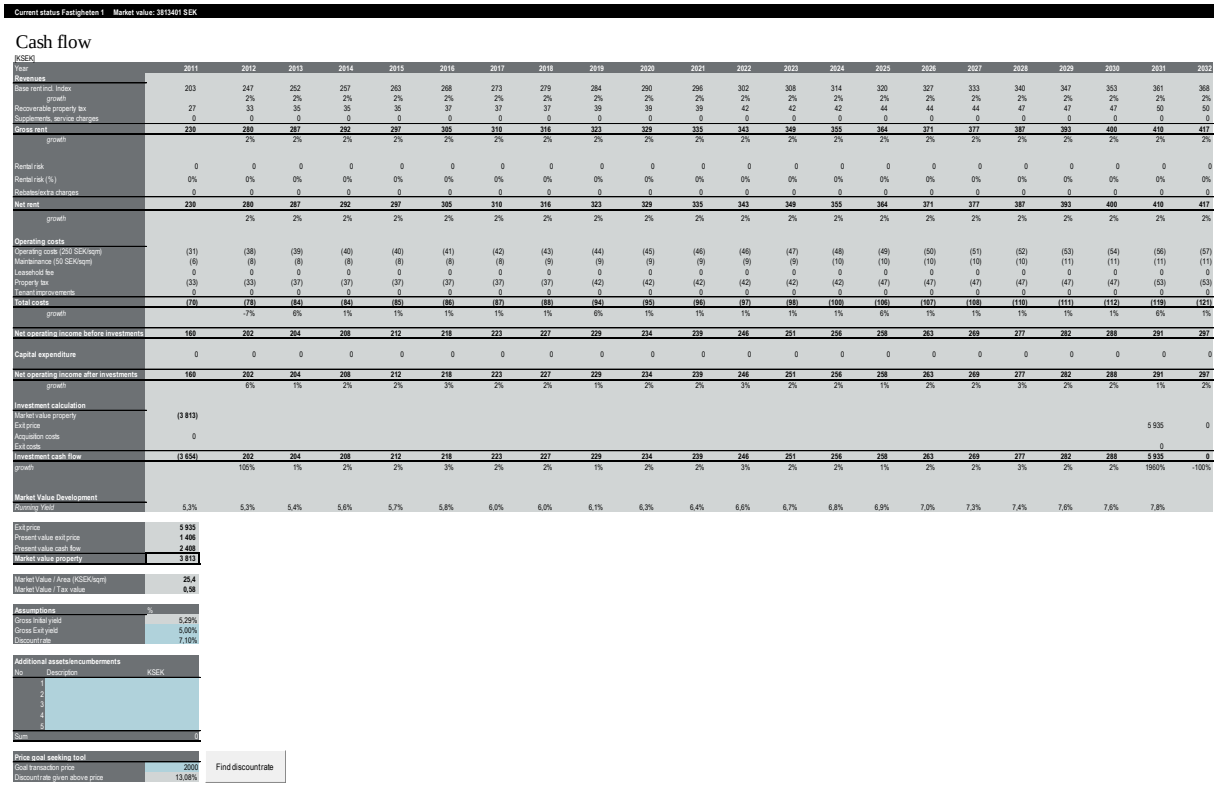
Type	%	Entry	Exit
Stamp duty	%	0,00%	0,00%
Legal, technical, financial	%	0,00%	0,00%
Property consultant	%	0,00%	0,00%
Total transaction costs	%	0,00%	0,00%

Figure 12. Screen shot of costs sheet of ANVIL.

Other costs such as leasehold fee, transaction costs (stamp duty, legal, consultant costs) and capital expenditure can be specified in the costs field. Even though service charge is not a cost but an income from the real estate owner's point of view, it is included in this sheet due to its similar nature to that of operating expenditure.

6.5 Cash flow

The cash flow sheet is one of the most thoroughly composed parts of the model. The net present value of future cash flows and residual value is calculated with a user specified discount rate (default calculated through Gordon's formula by request from the Research and Valuation department) and then turned into an estimated market value through an exit yield specified by the user. The cash flow sheet only displays the years within the holding period and is automatically updated when the holding period is changed in the input sheet. The data is displayed in thousands of SEK for a better overview.


Current status Fastigheten 1 Market value: 3813401 SEK

Cash flow

KSEK

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Revenues																						
Base rent incl. Index	203	247	252	257	263	268	273	279	284	290	296	302	308	314	320	327	333	340	347	353	361	368
growth		2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Recoverable property tax	27	33	35	35	35	37	37	37	39	39	39	42	42	42	44	44	44	47	47	47	50	50
Supplements, service charges	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross rent	**230**	**280**	**287**	**292**	**297**	**305**	**310**	**316**	**323**	**329**	**335**	**343**	**349**	**355**	**364**	**371**	**377**	**387**	**393**	**400**	**410**	**417**
growth		2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Rental risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rental risk (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Rebates/extra charges	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net rent	**230**	**280**	**287**	**292**	**297**	**305**	**310**	**316**	**323**	**329**	**335**	**343**	**349**	**355**	**364**	**371**	**377**	**387**	**393**	**400**	**410**	**417**
growth		2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Operating costs																						
Operating costs (200 SEK/sqm)	(31)	(38)	(39)	(40)	(40)	(41)	(42)	(43)	(44)	(45)	(46)	(46)	(47)	(48)	(49)	(50)	(51)	(52)	(53)	(54)	(56)	(57)
Maintenance (50 SEK/sqm)	(6)	(8)	(8)	(8)	(8)	(8)	(8)	(9)	(9)	(9)	(9)	(9)	(9)	(10)	(10)	(10)	(10)	(10)	(11)	(11)	(11)	(11)
Leasehold fee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Property tax	(33)	(33)	(37)	(37)	(37)	(37)	(37)	(37)	(42)	(42)	(42)	(42)	(42)	(42)	(47)	(47)	(47)	(47)	(47)	(47)	(53)	(53)
Tenant improvements	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total costs	**(70)**	**(78)**	**(84)**	**(84)**	**(85)**	**(86)**	**(87)**	**(88)**	**(94)**	**(95)**	**(96)**	**(97)**	**(98)**	**(100)**	**(106)**	**(107)**	**(108)**	**(110)**	**(111)**	**(112)**	**(119)**	**(121)**
growth		-7%	6%	1%	1%	1%	1%	1%	6%	1%	1%	1%	1%	1%	6%	1%	1%	1%	1%	1%	6%	1%
Net operating income before investments	**160**	**202**	**204**	**208**	**212**	**218**	**223**	**227**	**229**	**234**	**239**	**246**	**251**	**256**	**258**	**263**	**269**	**277**	**282**	**288**	**291**	**297**
Capital expenditure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net operating income after investments	**160**	**202**	**204**	**208**	**212**	**218**	**223**	**227**	**229**	**234**	**239**	**246**	**251**	**256**	**258**	**263**	**269**	**277**	**282**	**288**	**291**	**297**
growth		6%	1%	2%	2%	3%	2%	2%	1%	2%	2%	3%	2%	2%	1%	2%	2%	3%	2%	2%	1%	2%
Investment calculation																						
Market value property	**(3 813)**																					
Exit price																					5 935	0
Acquisition costs	0																					
Exit costs																					0	
Investment cash flow	**(3 654)**	**202**	**204**	**208**	**212**	**218**	**223**	**227**	**229**	**234**	**239**	**246**	**251**	**256**	**258**	**263**	**269**	**277**	**282**	**288**	**5 935**	**0**
growth		105%	1%	2%	2%	3%	2%	2%	1%	2%	2%	3%	2%	2%	1%	2%	2%	3%	2%	2%	1960%	-100%
Market Value Development																						
Running Yield	5,3%	5,3%	5,4%	5,6%	5,7%	5,8%	6,0%	6,0%	6,1%	6,3%	6,4%	6,6%	6,7%	6,8%	6,9%	7,0%	7,3%	7,4%	7,6%	7,6%	7,8%	

Exit price	**5 935**
Present value exit price	**1 406**
Present value cash flow	**2 408**
Market value property	**3 813**

Market Value / Area (KSEK/sqm)	**25,4**
Market Value / Tax value	**0,58**

Assumptions	%
Gross Initial yield	5,29%
Gross Exit yield	5,00%
Discount rate	7,10%

Additional assets/encumberments

No	Description	KSEK
1		
2		
3		
4		
5		
Sum		0

Price goal seeking tool	
Goal transaction price	2000
Discount rate given above price	13,08%

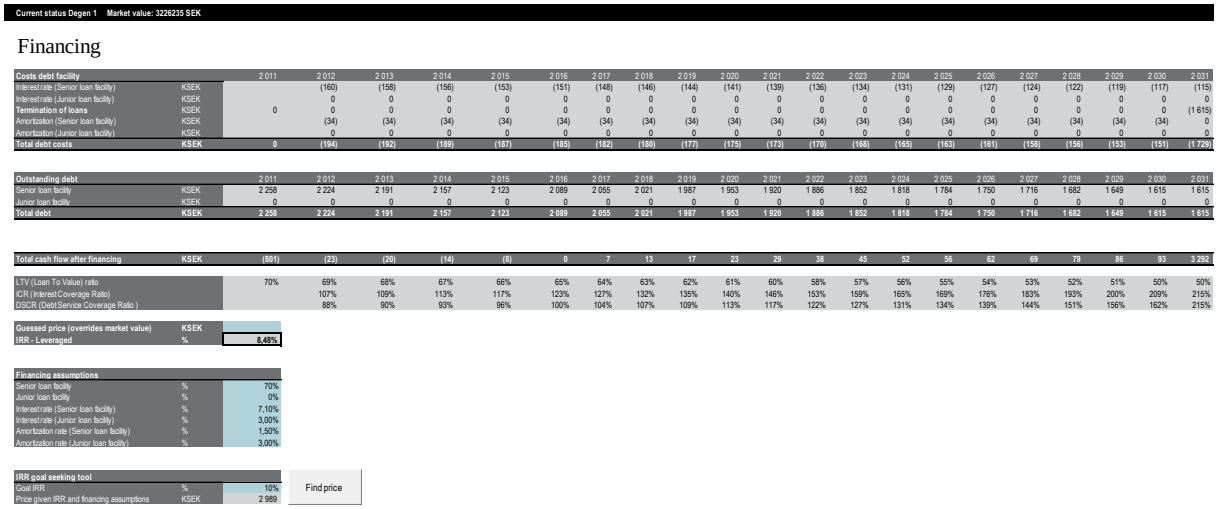
Find discountrate

Figure 13. Screen shot of cash flow sheet of ANVIL.

In order for the appraiser to obtain a full understanding of the present state of the cash flow analysis, all the necessary output data is presented in the cash flow sheet. Adding to this, a goal seeking tool was added at the bottom the sheet to find the discount rate that would translate to a specified market value. It is designed to answer the question: "If an investor a places a bid of X, what return does that investor require on his invested capital?". This feature was one of the Capital Markets specific requests and eliminates the need for a time consuming and inaccurate trial and error approach.

6.6 Financing

Similar to the cash flow sheet but with an emphasis on investment cash flow including mortgage and equity. The main task of this sheet is to calculate a leveraged internal rate of return (IRR). Similar to the cash flow sheet, a goal seeking tool for finding a transaction price for a given internal rate of return has been developed by request of the Capital Markets team. The user specifies an IRR and then presses a button to find the transaction price that equals that IRR. This is useful as many investors have IRR requirements when investing in assets.



Current status Degen 1 Market value: 322623S SEK

Financing

Costs debt facility		2 011	2 012	2 013	2 014	2 015	2 016	2 017	2 018	2 019	2 020	2 021	2 022	2 023	2 024	2 025	2 026	2 027	2 028	2 029	2 030	2 031
Interestrate (Senior loan facility)	KSEK		(160)	(158)	(156)	(153)	(151)	(148)	(146)	(144)	(141)	(139)	(136)	(134)	(131)	(129)	(127)	(124)	(122)	(119)	(117)	(115)
Interestrate (Junior loan facility)	KSEK		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Termination of loans	KSEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	(1 615)
Amortization (Senior loan facility)	KSEK		(34)	(34)	(34)	(34)	(34)	(34)	(34)	(34)	(34)	(34)	(34)	(34)	(34)	(34)	(34)	(34)	(34)	(34)	(34)	0
Amortization (Junior loan facility)	KSEK		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total debt costs	**KSEK**	**0**	**(194)**	**(192)**	**(189)**	**(187)**	**(185)**	**(182)**	**(180)**	**(177)**	**(175)**	**(173)**	**(170)**	**(168)**	**(165)**	**(163)**	**(161)**	**(158)**	**(156)**	**(153)**	**(151)**	**(1 729)**

Outstanding debt		2 011	2 012	2 013	2 014	2 015	2 016	2 017	2 018	2 019	2 020	2 021	2 022	2 023	2 024	2 025	2 026	2 027	2 028	2 029	2 030	2 031
Senior loan facility	KSEK	2 258	2 224	2 191	2 157	2 123	2 089	2 055	2 021	1 987	1 953	1 920	1 886	1 852	1 818	1 784	1 750	1 716	1 682	1 649	1 615	1 615
Junior loan facility	KSEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total debt	**KSEK**	**2 258**	**2 224**	**2 191**	**2 157**	**2 123**	**2 089**	**2 055**	**2 021**	**1 987**	**1 953**	**1 920**	**1 886**	**1 852**	**1 818**	**1 784**	**1 750**	**1 716**	**1 682**	**1 649**	**1 615**	**1 615**

Total cash flow after financing	KSEK	(801)	(23)	(20)	(14)	(8)	0	7	13	17	23	29	38	45	52	56	62	69	79	86	93	3 292

LTV (Loan To Value) ratio		70%	69%	68%	67%	66%	65%	64%	63%	62%	61%	60%	58%	57%	56%	55%	54%	53%	52%	51%	50%	50%
ICR (Interest Coverage Ratio)			107%	109%	113%	117%	123%	127%	132%	135%	140%	146%	153%	159%	165%	169%	176%	183%	193%	200%	209%	215%
DSCR (Debt Service Coverage Ratio)			88%	90%	93%	96%	100%	104%	107%	109%	113%	117%	122%	127%	131%	134%	139%	144%	151%	156%	162%	215%

Guessed price (overrides market value)	KSEK	
IRR - Leveraged	%	8,48%

Financing assumptions		
Senior loan facility	%	70%
Junior loan facility	%	0%
Interestrate (Senior loan facility)	%	7,10%
Interestrate (Junior loan facility)	%	3,00%
Amortization rate (Senior loan facility)	%	1,50%
Amortization rate (Junior loan facility)	%	3,00%

IRR goal seeking tool		
Goal IRR	%	10%
Price given IRR and financing assumptions	KSEK	2 989

Find price

Figure 14. Screen shot of financing sheet of ANVIL.

Various key indicators are presented on a yearly basis, such as loan to value ratio (LTV) and interest coverage ratio (ICV). The user can specify a senior and a junior loan with separate interest rates and amortisation terms. Like the cash flow sheet, the financing sheet only displays the years within the holding period and is automatically updated when the holding period is changed in the input sheet.

6.7 Sensitivity analysis

Sensitivity analysis is a tool that automatically calculates how the market value is affected if parameters are changed. The appraiser can then by the click of a button see how much the market value for the subject property would change if for instance the market rent would change X%. This is interesting as it reveals how sensitive the asset is for changes not only intrinsic to the asset but also inflation that is a macroeconomic variable.

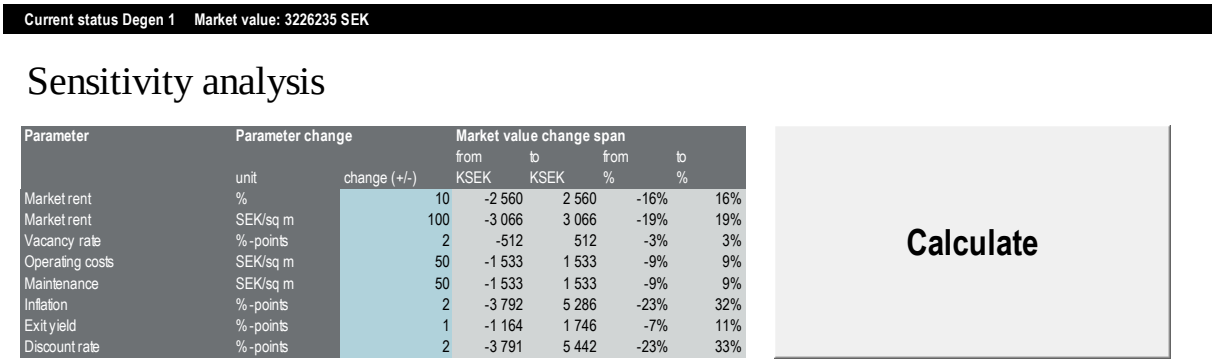
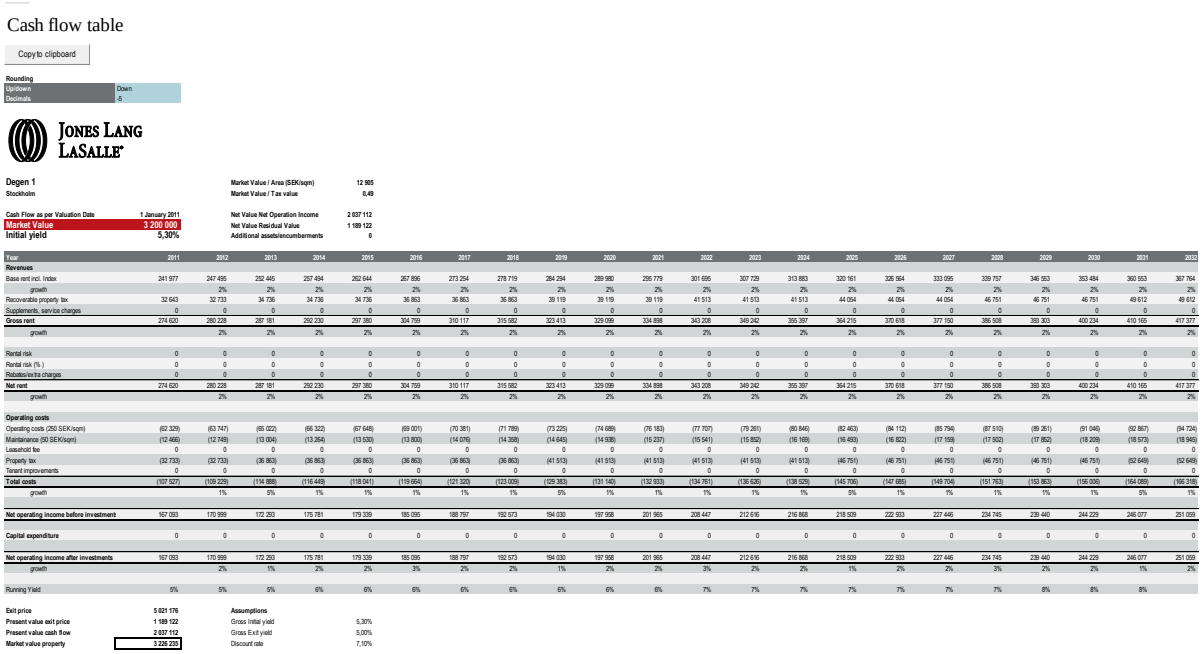


Figure 15. Screen shot of sensitivity sheet of ANVIL.

The sensitivity analysis was created through macros written in Visual Basic. The macro is highly efficient, using only roughly 160 cells for calculation in addition to the user interface as seen in figure 16 (although the sensitivity analysis macro accounts for approximately 400 rows of Visual Basic code). Originally, the macro generated only one side of the span (the input units were sensitive to positive or negative numbers) but a full two sided range was introduced after request from the Research and Valuation department. The reason was part pedagogical in terms of client report, but also due to the fact that some of the parameters affected the result asymmetrically, for instance exit yield and discount rate.

6.8 CF table

A Cash flow table for client report. Automatically updated with included information and cash flow period length. The user can select the number of decimals displayed (for example -6 to round to the closest million) and if the rounding should be upwards or downwards. A set of assumptions and key indicators are neatly presented accompanied with the company logotype.



Cash flow table

Copy to clipboard

Rounding

Up/down	Down
Decimals	-5

JONES LANG LASALLE

Degen 1
Stockholm

Market Value / Area (SEK/sqm)	12 995		
Market Value / Tax value	0,49		
Cash Flow as per Valuation Date	1 January 2011	Net Value Net Operation Income	2 037 112
Market Value	3 200 000	Net Value Residual Value	1 189 122
Initial yield	5,30%	Additional assets/encumberments	0

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Revenues																						
Base rent incl. Index	241 977	247 495	252 445	257 494	262 644	267 896	273 254	278 719	284 294	289 980	295 779	301 695	307 729	313 883	320 161	326 564	333 095	339 757	346 553	353 484	360 553	367 764
growth		2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Recoverable property tax	32 643	32 733	34 736	34 736	34 736	36 863	36 863	36 863	39 119	39 119	39 119	41 513	41 513	41 513	44 054	44 054	44 054	46 751	46 751	46 751	49 612	49 612
Supplements, service charges	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross rent	274 620	280 228	287 181	292 230	297 380	304 759	310 117	315 582	323 413	329 099	334 898	343 208	349 242	355 397	364 215	370 618	377 150	386 508	393 303	400 234	410 165	417 377
growth		2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Rental risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rental risk (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rebates/extra charges	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net rent	274 620	280 228	287 181	292 230	297 380	304 759	310 117	315 582	323 413	329 099	334 898	343 208	349 242	355 397	364 215	370 618	377 150	386 508	393 303	400 234	410 165	417 377
growth		2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Operating costs																						
Operating costs (250 SEK/sqm)	(62 329)	(63 747)	(65 022)	(66 322)	(67 648)	(69 001)	(70 381)	(71 789)	(73 225)	(74 689)	(76 183)	(77 707)	(79 261)	(80 846)	(82 463)	(84 112)	(85 794)	(87 510)	(89 261)	(91 046)	(92 867)	(94 724)
Maintenance (50 SEK/sqm)	(12 466)	(12 749)	(13 004)	(13 264)	(13 530)	(13 800)	(14 076)	(14 358)	(14 645)	(14 938)	(15 237)	(15 541)	(15 852)	(16 169)	(16 493)	(16 822)	(17 159)	(17 502)	(17 852)	(18 209)	(18 573)	(18 945)
Leasehold fee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Property tax	(32 733)	(32 733)	(36 863)	(36 863)	(36 863)	(36 863)	(36 863)	(36 863)	(41 513)	(41 513)	(41 513)	(41 513)	(41 513)	(41 513)	(46 751)	(46 751)	(46 751)	(46 751)	(46 751)	(46 751)	(52 649)	(52 649)
Tenant improvements	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total costs	(107 527)	(109 229)	(114 888)	(116 449)	(118 041)	(119 664)	(121 320)	(123 009)	(129 383)	(131 140)	(132 933)	(134 761)	(136 626)	(138 529)	(145 706)	(147 685)	(149 704)	(151 763)	(153 863)	(156 006)	(164 089)	(166 318)
growth		1%	5%	1%	1%	1%	1%	1%	5%	1%	1%	1%	1%	1%	5%	1%	1%	1%	1%	1%	5%	1%
Net operating income before investment	167 093	170 999	172 293	175 781	179 339	185 095	188 797	192 573	194 030	197 958	201 965	208 447	212 616	216 868	218 509	222 933	227 446	234 745	239 440	244 229	246 077	251 059
Capital expenditure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net operating income after investments	167 093	170 999	172 293	175 781	179 339	185 095	188 797	192 573	194 030	197 958	201 965	208 447	212 616	216 868	218 509	222 933	227 446	234 745	239 440	244 229	246 077	251 059
growth		2%	1%	2%	2%	3%	2%	2%	1%	2%	2%	3%	2%	2%	1%	2%	2%	3%	2%	2%	1%	2%
Running Yield	5%	5%	5%	6%	6%	6%	6%	6%	6%	6%	6%	7%	7%	7%	7%	7%	7%	7%	8%	8%	8%	

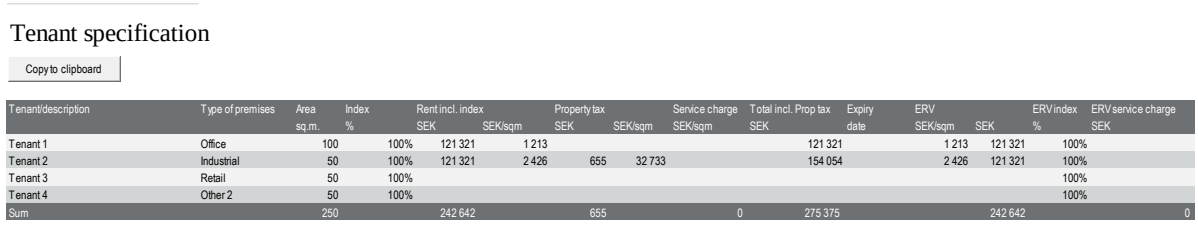
Exit price	**5 021 176**	**Assumptions**	
Present value exit price	**1 189 122**	Gross Initial yield	5,30%
Present value cash flow	**2 037 112**	Gross Exit yield	5,00%
Market value property	**3 226 235**	Discount rate	7,10%

Figure 16. Screen shot of output sheet ("CF table") of ANVIL.

A full scale example of the output table generated from the CF table sheet is included in appendix 1.

6.9 Table tenant specification

Tenant specification table for client report. The number of rows automatically adjusts to the number of rows added in the tenancy schedule, there is no need for the user to manually add or delete row for it to suit the client report. The sheet includes a button to directly put copy the table to the clipboard which adjusts to the number of rows as well. The table is always correctly formatted, with every other row formatted with different colours to comply with the graphic policy of Jones Lang LaSalle no matter how many rows added or if it is an even or odd number. This was accomplished through combining formulas and the conditional formatting tool in Excel.



Tenant specification

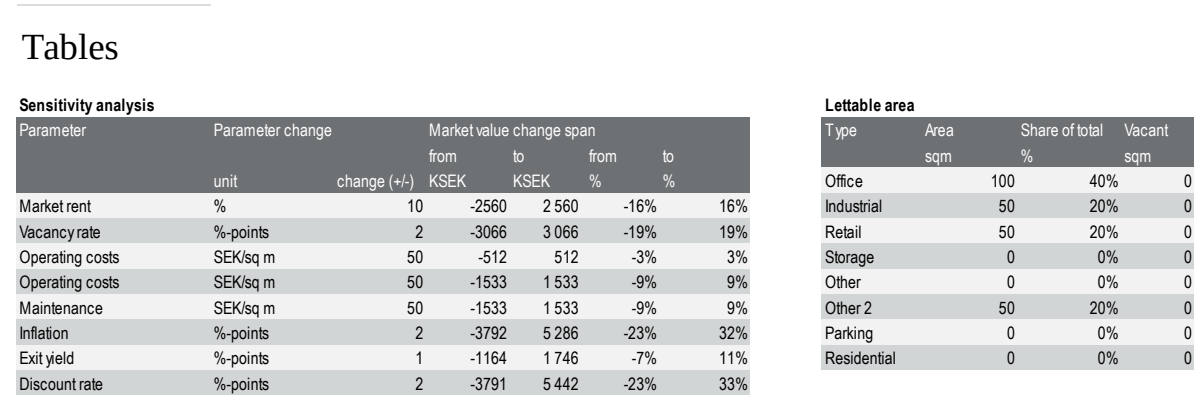
Copy to clipboard

Tenant/description	Type of premises	Area sq.m.	Index %	Rent incl. index SEK	Rent incl. index SEK/sqm	Property tax SEK	Property tax SEK/sqm	Service charge SEK/sqm	Total incl. Prop tax SEK	Expiry date	ERV SEK/sqm	ERV SEK	ERV index %	ERV service charge SEK
Tenant 1	Office	100	100%	121 321	1 213				121 321		1 213	121 321	100%	
Tenant 2	Industrial	50	100%	121 321	2 426	655	32 733		154 054		2 426	121 321	100%	
Tenant 3	Retail	50	100%										100%	
Tenant 4	Other 2	50	100%										100%	
Sum		250		242 642		655		0	275 375			242 642		0

Figure 17. Screen shot of tenant specification table sheet of ANVIL.

6.10 Tables 2

Additional tables for client report. There are currently two tables in this sheet, Sensitivity analysis table and lettable area, but this is an area that is expected to be expanded as more feedback from users is received.



Tables

Sensitivity analysis

Parameter	Parameter change		Market value change span			
			from	to	from	to
	unit	change (+/-)	KSEK	KSEK	%	%
Market rent	%	10	-2560	2 560	-16%	16%
Vacancy rate	%-points	2	-3066	3 066	-19%	19%
Operating costs	SEK/sq m	50	-512	512	-3%	3%
Operating costs	SEK/sq m	50	-1533	1 533	-9%	9%
Maintenance	SEK/sq m	50	-1533	1 533	-9%	9%
Inflation	%-points	2	-3792	5 286	-23%	32%
Exit yield	%-points	1	-1164	1 746	-7%	11%
Discount rate	%-points	2	-3791	5 442	-23%	33%

Lettable area

Type	Area	Share of total	Vacant
	sqm	%	sqm
Office	100	40%	0
Industrial	50	20%	0
Retail	50	20%	0
Storage	0	0%	0
Other	0	0%	0
Other 2	50	20%	0
Parking	0	0%	0
Residential	0	0%	0

Figure 18. Screen shot of table sheet of ANVIL.

6.11 Graphs

Various graphs for client report. This sheet is expected to be expanded in the near future as user provide their feedback and suggestions. In order for the legend in the lettable area graph to not include premises types that are irrelevant for any given property, a macro button was created that checks the area entered in the tenancy schedule.

It is possible to program the graph to be automatically updated whenever the tenancy schedule is changed, however, the decision to leave it to a button to manually update the graph was made to prevent unnecessary workload for the computer running the program. The computers at Jones Lang LaSalle vary in age and performance (even though the IT equipment are generally well maintained and updated), therefore it is advantageous to keep the valuation model as lightweight as possible. After all, the model includes over 7600 cells and 1000 rows of VBA code.

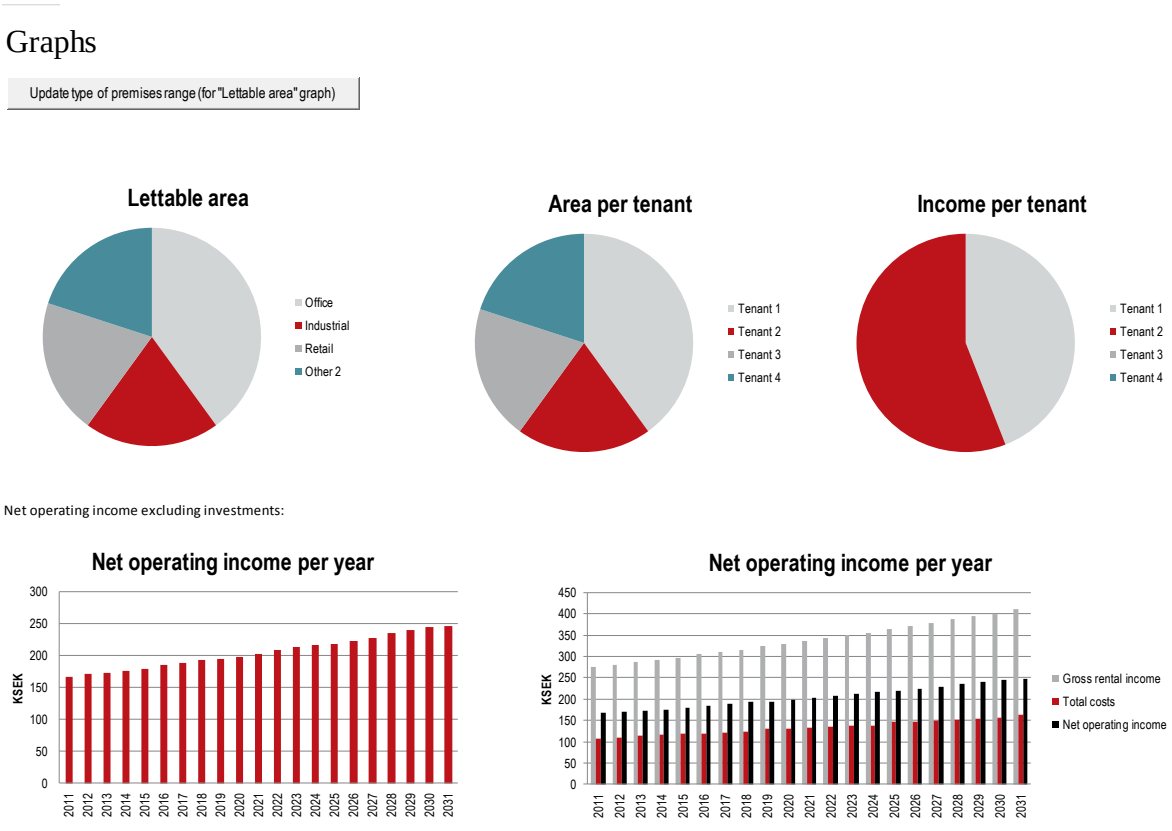


Figure 19. Screenshot of graph sheet in ANVIL.

6.12 Help cells

Cells solely used for calculation, no direct user input or output. Hidden when the model is presented to the user, minimising the risk of changes by the user by mistake.

7. Advantages

The advantages of the resulting model called ANVIL compared to existing discounted cash flow model available to Jones Lang LaSalle are as follows:

- Streamlined and lucid interface that is easy to understand and use.
- Automated features added through Visual Basic scripts that contribute to a more efficient valuation process.
- Precise time variables used in the model. Valuation date can be specified at a specific day and holding period can be specified from one to twenty years.
- Advanced calculations that eases the work of an appraiser, for instance property tax that have complex regulations that makes them not a straight forward task if done manually.
- Readily available, automatically updated graphs and tables that can be inserted directly into a client report without manual adjustments.
- Future proof. If starting date is later than 2011 the year labels in all tables updates to start at the earliest relevant year.
- Brand specific and compliant with Jones Lang LaSalle graphic identity.
- Relevant not only to the research department but to all business lines as all departments were given the opportunity to affect the development and to make suggestions and requests of features.
- Prepared for future adjustments, few cells are directly referenced in the Visual basic script but are referenced through the name managed making them intact in the event of reorganisation of the layout.
- Easily adapted to other Nordic countries in the Jones Lang LaSalle corporation, potentially making the value gained compared to invested work grow severalfold.

8. Implementation

The implementation of ANVIL has been successive during the development to ensure that all affected parties are involved in the project and are able to provide feedback and suggestions. When ANVIL was ready for use, it was placed on the shared network drive and a memo was sent to affected staff informing them about its existence. It is free for anyone at Jones Lang LaSalle to use and change, but the development "owners" are still the original authors. The model is continuously updated and improved as new requests or suggestions surfaces. There are no binding policy that forces anyone to use it, it stands on its own merit.

During the annual EMEA research conference held in Barcelona in May 2011, awareness was raised of the existence of ANVIL among the Nordic countries. The initiative was welcomed and a lot of discussion emerged. Finland expressed an interest in the new model and is currently testing and evaluating it.

8.1 Valuation workshop at Jones Lang LaSalle

Early on in the process of acquirement of sufficient data to start building sheets, decision was made that a full day would be set aside for a valuation workshop. This valuation workshop was to be held on the 26th of May 2011, led by Mrs. Åsa Linder, National Director, Head of Research and Valuation, Adam Nilsson, Research & Valuation Analyst and Ahmed Fetibegovic, Capital Markets Analyst.

The range of the workshop was for all Jones Lang LaSalle staff in Sweden, approximately 120 professionals covering all Scandinavian markets except for Finland where Jones Lang LaSalle has a separate office. The schedule of the workshop was to have Mrs. Åsa Linder, Adam Nilsson and Ahmed Fetibegovic initially present the new valuation model ANVIL for the full Swedish staff.

Onward, to continue on with assigning groups with members from different divisions such as Asset Management, Corporate Solutions, Capital Markets, Leasing and Economy. Mrs. Åsa Linder had before the workshop generated a valuation case based on a typical valuation which Mrs. Åsa Linder found representative of everyday work of an appraiser. The data was made available for the assigned groups, and the mission of the day was to deliver the best possible estimate of the subject property value using the valuation model ANVIL, created by Adam Nilsson and Ahmed Fetibegovic as a part of this thesis.

As the valuation model is developed with a requirement of more columns than previously supported per sheet, users had to use newer versions of excel (versions newer than 2003) as this is supported only in the 2007 and 2010 versions. Groups teamed up and worked all day with analysis of the needed information to assess a full scale valuation. To the groups' aid, Mrs. Åsa Linder had prepared investment highlights, property facts, location and access, planning, financial information, rent roll, information about the tenants and tenancy layout.

Throughout the day, groups sent emissaries to ask questions about technical, legal and economic facts and requirements to perform the valuation in a correct manner. Finally, all groups printed their cash flow tables, and handed them in to Mrs. Åsa Linder who concluded that the spread of values on average was less than approximately 10%. The success of the new valuation model was undeniable at this stage, as a substantial part of the "appraisers of the day" had never valued property before. The result proved robustness, accuracy and user friendliness which were the main targets of the valuation model ANVIL.

Needless to say, not all participants in the workshop were professional real estate appraisers. However, the majority is involved in adding value to real estate directly or indirectly. Consequently, the question of what drives real estate value is highly relevant to all business lines at Jones Lang LaSalle and the valuation exercise was useful to elucidate what that might be. The participants in the valuation workshop was able, thanks to ANVIL, to easily experiment with the main parameters that define real estate value and instantly discover how it changes the estimated market value.

The discussion after the valuation exercise when the output sheets were collected was also highly valuable from an educational point of view. Questions was raised to investigate what the differences in value stem from, and efforts were made to illuminate those differences which shed additional light upon what drives value.

After the workshop, which was a full day event, comments were collected by a select number of Jones Lang LaSalle employees at different divisions and positions.

"The model is looking good. People who have never seen a cash flow model were able to appraise an accurate value with the help of only raw data, bears witness that the model is user friendly and robust." – Åsa Linder, National Director, Head of Research and Valuation

"We really need a new cash flow model. It is terrific that it has finally been developed, and it will be thoroughly debugged and tested by the Capital Markets team." – Bojan Ticic, Analyst, Capital Markets

"The delivery of a new cash flow model was long overdue, it has met the expectations we had. A welcomed surprise was the effort put into the financing part of the model which is the main part of the cash flow model that we use. Once the appraisal is over, the investment analysis takes place asking the question 'Does this investment make sense to our investor?'" – Norbert Adamek, Analyst, Capital Markets

"The user friendliness was quite good. The model looks nice and professional, and made me feel competent to appraise even though I do not engage in such questions in my everyday line of work. That has to be a good sign!" – Stefan Regén, Project manager, Corporate Solutions

"The outcome of the work put into this is impressive. The model is unlike anything I've worked with, and I feel even more confident about it since I know that the programmers of the model work at Jones Lang LaSalle, which means continuous updates and modifications to a model which is satisfying already." – Ani Chirilas, Senior Appraiser, Research and Valuation

"I had not realized the scope of work put into this model until today. I'm curious about the man hours put into this project, it must be many. I can assure you that the model will be used in our everyday work at Asset Management." – Therese Hääger, Property Manager, Asset Management

9. Conclusion

In the fourth quarter of 2010, decision was made at Jones Lang LaSalle to develop a new valuation model. The decision originated from the fact that the models in use were not optimized for Jones Lang LaSalle, and lacked necessary quality, robustness, and design and user friendliness. At the time, models from various Jones Lang LaSalle offices around the EMEA were used in a combination to ensure a good float value. Naturally, this was not the optimal solution for a company that has rigorous requirements on professionalism, accuracy and technical leverage on the appraisals delivered to its' clients.

The task was forwarded to the authors of this report, to construct a new valuation model for Jones Lang LaSalle that would meet the requirements currently lacking in existing models in use at the company. Now, when the model has been developed and delivered to Jones Lang LaSalle, some conclusions can be made on the level of success this undertaking resulted in, and the processes that led there.

When programming the new model, it soon became apparent what importance the model carries to other divisions of Jones Lang LaSalle apart from Research & Valuation which was the original client that the authors tried to satisfy. For instance, Capital Markets, the real estate transaction and finance department of Jones Lang LaSalle instantly contacted the authors with several requests that were of major importance for them in the model. The requests were mainly finance oriented, with functions such as a guess-price function to see the IRR of the investment at any given value. Another important function according to Capital Markets is the ability for the model to search for the value representing any given IRR.

When dissecting the feedback received from Jones Lang LaSalle, it becomes obvious that agencies work in different ways. All agencies require a certain amount of specialization in the models used for assessment of property value; therefore much effort was put into identification of Jones Lang LaSalle-specific factors of the mainly standardized route of appraisal. The model does not have to be tailor made per se, although careful consideration must be taken to the specific practices at the consultancy utilizing the model in order to achieve efficiency.

Such factors at Jones Lang LaSalle were mainly design oriented, but also a few very specific requirements such as the ability to specify vacancies per premises type over periods of time of choice. Furthermore, there were requests of which key indicators to be included in the final output sheet, which is not adjustable in corporate software suites. The design oriented requests

were mainly about receiving automated charts and diagrams that were formatted in the standardized Jones Lang LaSalle color palette and font family in order to save time and resources.

One very important conclusion made from the effort put into this task, is how central a well-functioning valuation model is in terms of efficiency at a valuation department. Indeed, doing what you are educated to do, and what you are passionate about, instead of putting valuable time into side work such as designing charts, figures and cash flows, is bound to increase the efficiency of any agency. Undeniably, as time is of the essence for a rising appraiser, so is efficiency at the very core of profitability.

10. Discussion

Working on developing a new valuation model for a global real estate agency like Jones Lang LaSalle with all of the expectations that comes along with the task, is not an easy mission. During the course of making it come together, many setbacks have been experienced. It was not seldom that 30 to 40 man hours went to waste due to misunderstandings or misinterpretation of the needs of Jones Lang LaSalle. A lot of the work had to be redone, and redone, due to false assumptions and change of minds at the agency. Therefore, the feeling of accomplishment feels yet larger today.

In the beginning of making ANVIL come to life, examination was made of numerous competing valuation models. When examining these, it was understood that they had many flaws. In the worst cases, critical technical errors were found that skewed property values. One typical example of a critical error made in "desktop" valuation models is that values decreased if the valuation period started in the middle or late in a year, because of the first cash flow period becoming smaller, i.e. no mathematical solution was made to offset the entire holding period by the amount of time which had already passed in the first holding year.

There are numerous technical flaws at previous valuation models to be discussed, and the model which was developed for Jones Lang LaSalle is destined to have a successor, which will likely have a few words to say about this one. However, the task of developing and delivering a valuation model forged to the specific needs of Jones Lang LaSalle has been completed with a result that met the high expectations not only by the authors, but the whole Swedish office.

The main criticism pointed towards the newly developed valuation model, is the incompatibility with older versions of Excel, which was a necessary sacrifice made to make the model sufficiently robust with the approach chosen. The old Excel format simply does not possess the features and range required. The authors are aware of the problem this creates with some employees still using the old version of the Microsoft software suit, but the decision was made to go on this path due to the main divisions who are to use this software are the Research & Valuation, Capital Markets and Asset Management divisions who all mostly have at least Office 2007 installed on their computers.

The software is compatible with Office 2007 and newer versions, and all staff are currently phasing out their old hardware for new workstations. These workstations all have Office 2010

installed with Windows 7, which will eliminate this problem eventually. Developing and maintaining two separate version of the model to remedy this issue would be too time consuming and cumbersome and frankly, not feasible due to the above described situation.

Furthermore, criticism from the Capital Markets division was pointed to the fact more work could have been put into the financial part of the valuation model. Many arguments have been undertaken to defend the integrity of a valuation model that does not take into consideration the scenario of a specific investor. To answer this criticism, the authors would in addition like to quote:

"The difference between doing an investment analysis and estimating market value is that while market value is a same-for-all number that theoretically reflect the average opinion of buyers and a seller, an investment analysis is tailored for an individual whose objectives, attitudes toward risk, ability to borrow, and tax situation may vary considerable from the average. In many cases, the investment analysis begins where the market value appraisal ends; seeking an answer to the question of whether paying at or around the market value makes sense for a given individual."

- Kenneth M. Lusth, Real Estate Valuation, Principle and Applications, 2002

In the later parts of development of the model, the authors added several asked for financial functions. One of these, among the more sophisticated functions of the whole model, is a VBA-script which finds the underlying maximum value of the property at a given required IRR. Also, a solution was found to the problem where the running loan-to-value ratio could turn bad if the property was likely to become vacant periodically, for instance single-tenant properties where the appraiser has to count with a void period.

In these situations, you will have a property which will have a negative NOI for a period of time, which will yield an unacceptable LTV-situation when using running exit price, that is calculated through the direct capitalization approach, to calculate LTV over time. This problem for instance, was fixed in an innovative way. Together with the appraisers, the authors based the gathered valuation input to automate a VPV (vacant possession value), which is then used as a threshold value for the running LTV in the financial part of the valuation model. That means, property value will not go under the fixed VPV no matter vacancy periods in the subject property. This is a solution which is currently unavailable in any software available on the market today.

To return to the discussion about competing models, one would be surprised of the amount of these kinds of flaws that are critically detrimental to final appraisal. Indeed, working on developing a new valuation model was an eye opener to the occurring lack of technical skill at most real estate agencies operating not only in Scandinavia, but across Europe. At Jones Lang LaSalle, these flaws were efficiently discovered by management early on, and the need for a new valuation model was established.

At the time of presentation for a possible solution for Jones Lang LaSalle, the authors of this thesis were employed as Research Assistants at the Research and Valuation department and final year students at the Real Estate Management programme at the Royal Institute of Technology in Stockholm. In everyday work as a Research Assistant, a lot of work is put into mastering the art of Excel and large quantities of data. Therefore, possession of the necessary skills to perform such a task was met technically, practically and theoretically. The authors were given insight into commercial valuation practices, which was fundamental in the process of developing the new valuation model.

Initially, one of the goals with the development of a new valuation model was to have a fully automated report creator, i.e. a VBA scripted program that with a mouse-click takes all necessary data and results from the model, and exports it to a predefined docx or publisher file with fixed layout, formatting, styles and structure stored on the company network hard disk drive. A feature like this would add value as one of the most time consuming parts of the work of an appraiser is the work on the actual client report.

Unfortunately, there was no time to build such a function. Creating such a function would be expanding the scope of the model drastically, pushing the very limits of what is relevant for the authors to work with. Programming at that level would be a suitable project for an educated programmer, and it would have been interesting to have someone with that background in the team. Simply put, it was beyond reasonable level of competence of the authors and any employee at Jones Lang LaSalle to instruct on such an ambition. However, as described in the main part of the thesis, the authors have put substantial amounts of work into making the model easy for direct report interaction. All presentation data found in the model are designed so that it may be directly inserted as a vector enhanced metafile (scalable to ensure high quality prints) into any Microsoft Office compatible program.

Sources

Litterature

Andersson, J.O., Ekström, C., & Gabrielsson, A. (2004) *Finansiering och kalkylering*. Stockholm: Liber AB

Appraisal Institute. (2001). *The appraisal of real estate*. Appraisal Institute.

Damodaran, A.(2002). *Investment valuation*. New York: John Wiley & Sons, Inc

Lantmäteriverket & Mäklarsamfundet. (2008), *Fastighetsvärdering.* Gävle Lantmäteriverket

Lusht, M. Kenneth (2002) *Real Estate Valuation, Principle and Applications*, Stockholm

Råckle, G,. & Waxler, R (2005*). Fastighetsekonomisk analys och fastighetsrätt med. fastighetsnomenklatur*. Sverige: Fastighetsnytt Förlags AB.

Lind, H. (2003). Value concepts, value information and cycles on the real estate market. *Journal of Property Investment & Finance* – vol. 23, Iss: 1 pp 141-147.

Interviews

Norbert Adamek, Capital Markets Analyst, interview, Apr 27 2011.

Ani Chirilas, Senior surveyor at Jones Lang LaSalle, interview, Apr 25 2011.

Patrik Floberg, Capital Markets Analyst at Jones Lang LaSalle, interview, Apr 27 2011.

Therese Hääger, Property Manager at Asset Management at Jones Lang LaSalle, interview, Apr 27 2011.

Åsa Linder, National Director and Head of Research and Valuation at Jones Lang LaSalle, interview, Apr 25 2011, May 3 2011, May 4 2011, May 5 2011, May 23 2011, May 24 2011, May 25 2011.

Stefan Regén, Project Manager at Corporate Solutions at Jones Lang LaSalle, interview, Apr 27 2011.

Benjamin Rush, MRICS Senior surveyor at Jones Lang LaSalle, interview, Apr 25 2011.

Bojan Ticic, , Capital Markets Analyst at Jones Lang LaSalle, interview, Apr 27 2011.

Electronic sources

http://www.skatteverket.se/foretagorganisationer/skatter/fastighet/fastighetstaxering.4.76a43be412206334b89800043506.html

Appendix 1. Example of cash flow output sheet

JONES LANG LASALLE

Fastigheten 1
Stockholm

Market Value / Area (SEK/sqm)	23 737
Market Value / Tax value	1,19

Cash Flow as per Valuation Date	1 March 2011
Market Value	**3 600 000**
Initial yield	**5,30%**

Net Value Net Operation Income	1 398 480
Net Value Residual Value	2 162 026
Additional assets/encumberments	0

Year	part of 2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Revenues												
Base rent incl. Index	202 756	247 495	252 445	257 494	262 644	267 896	273 254	278 719	284 294	289 980	295 779	301 695
growth		2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Recoverable property tax	12 534	15 000	15 918	15 918	15 918	16 893	16 893	16 893	17 927	17 927	17 927	19 024
Supplements, service charges	0	0	0	0	0	0	0	0	0	0	0	0
Gross rent	215 290	262 495	268 363	273 412	278 562	284 789	290 147	295 612	302 220	307 906	313 706	320 719
growth		2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Rental risk	(10 765)	(13 125)	(13 418)	(13 671)	(13 928)	(14 239)	(14 507)	(14 781)	(15 111)	(15 395)	(15 685)	(16 036)
Rental risk (%)	-5%	-5%	-5%	-5%	-5%	-5%	-5%	-5%	-5%	-5%	-5%	-5%
Rebates/extra charges	0	0	0	0	0	0	0	0	0	0	0	0
Net rent	204 526	249 370	254 945	259 741	264 634	270 550	275 640	280 831	287 109	292 511	298 021	304 683
growth		2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Operating costs												
Operating costs (250 SEK/sqm)	(31 336)	(38 127)	(38 889)	(39 667)	(40 460)	(41 270)	(42 095)	(42 937)	(43 796)	(44 672)	(45 565)	(46 476)
Maintainance (50 SEK/sqm)	(6 267)	(7 625)	(7 778)	(7 933)	(8 092)	(8 254)	(8 419)	(8 587)	(8 759)	(8 934)	(9 113)	(9 295)
Leasehold fee	0	0	0	0	0	0	0	0	0	0	0	0
Property tax	(15 000)	(15 000)	(16 893)	(16 893)	(16 893)	(16 893)	(16 893)	(16 893)	(19 024)	(19 024)	(19 024)	(19 024)
Tenant improvements	0	0	0	0	0	0	0	0	0	0	0	0
Total costs	(52 603)	(60 752)	(63 560)	(64 493)	(65 445)	(66 416)	(67 407)	(68 417)	(71 579)	(72 630)	(73 702)	(74 795)
growth		-3%	5%	1%	1%	1%	1%	1%	5%	1%	1%	1%
Net operating income before investment	151 923	188 618	191 385	195 248	199 189	204 133	208 233	212 415	215 531	219 881	224 319	229 887
Capital expenditure	0	0	0	0	0	0	0	0	0	0	0	0
Net operating income after investments	151 923	188 618	191 385	195 248	199 189	204 133	208 233	212 415	215 531	219 881	224 319	229 887
growth		4%	1%	2%	2%	2%	2%	2%	1%	2%	2%	2%
Running Yield	5%	5%	5%	6%	6%	6%	6%	6%	6%	6%	6%	7%

Exit price	**4 597 748**
Present value exit price	**2 162 026**
Present value cash flow	**1 398 480**
Market value property	**3 560 507**

Assumptions	
Gross Initial yield	5,30%
Gross Exit yield	5,00%
Discount rate	7,10%