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Timberland valuation

Current theory and practice in Estonia and Sweden

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Abstract

In some countries forests are state or community owned and there is no market for forest land. However, in many countries timberland can be privately owned and thus there exists an active market for it. In Estonia and Sweden private timberland ownership is very high, 54% and 66% of the total timberland area respectively. Since property transactions in general require valuations, the need for timberland valuations is high in these countries.

There are several timberland valuation approaches discussed and analysed in timberland valuation literature. Three of the most prominent approaches are the income approach, the sales comparison approach and the cost approach.

Although timberland valuation is well-founded in theory, it is often rather different in practice. The timberland valuation methods as well as the underlying assumptions in the methods can vary significantly across countries and regions. The dissimilarities and confusion in timberland valuations are, at least to some extent, related to the circumstance that existing valuation standards comprehend very little guidance regarding timberland appraisal.

The thesis in hand is a comparative case study, in which the same interview questions were asked from several timberland appraisers in Estonia and Sweden in order to find out how timberland is appraised in these countries.

It was found that the timberland valuation approaches used within a country are rather similar, but differ when comparing Estonia with Sweden. The assumptions used in the valuation approaches vary between countries as well as across companies within a country. In Estonia
the appraisers use only the income approach to value a timberland, while in Sweden the
appraisers use both the comparable sales approach and the income approach. There are,
however, substantial differences in the way the income method is carried out in each country.
In Sweden the appraisers use the income approach, to a great extent, in accordance with
scientific literature, which cannot be said about the Estonian appraisers. The main differences
in the income approach across the countries are the future cash flow treatment, the
premerchantable timber value treatment and the length of the time period in the income
approach. Along with many other details about timberland valuation practices in Estonia and
Sweden, the study also found that none of the appraisers are using the uncertainty intervals in
their valuation reports.

The consistency and solidarity of Swedish timberland valuation practice results from the
existence of the guidelines and recommendations along with the valuation program provided
by the National Land Survey of Sweden. Latter is a clear sign of the importance of valuation
standards and guidelines.
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1. Introduction

1.1 Background

There is around 4 billion hectares of timberland in the world, which is approx. 31% out of the total land area. The largest timber stocks are situated in Brazil, Russia, the United States and Canada. The total timber volume in the world is approximately 527 billion m$^3$. The average annual volume of felled roundwood in the world between 2003 and 2007 amounted to 3.4 billion m$^3$. Timber is mainly used in saw mill industry, panel and plywood industry, pulp industry and for energy. Besides timber producing, forest is also important for recreational and cultural activities, producing non-wood forest products such as fruits, mushrooms, nuts, etc. and also for maintaining biodiversity and cleaning air and water. (Eurostat, 2011)

In some countries forests are state or community owned and there is no market for forest land. However, in many countries timberland can be privately owned and thus there is an active market for it. This is the case in EU countries, where a big share of timberland is owned by the state, but private ownership also has a considerably big part and the market is quite active.

In Sweden the total area of timberland is approximately 66% of the total land area. There is approximately 11.8 million hectares of privately owned timberland, which is about half of the total timberland area. The total number of private timberland owners amounts to 403 707 and around 2 500\(^1\) transactions are conducted annually.\(^2\)

In Estonia timberland constitutes about 54% of the total land area. Privately owned timberland amounts to 1.0 million hectares, which is also about half of the total timberland area in the country. There are around 97 300 private timberland owners and 2 050 transactions are conducted annually.\(^3\)

Consequently, the need for timberland valuations is high and is mostly driven by the changes in private timberland ownership. Additionally, timberland valuations might be needed for financial reporting, asset monitoring, loan collateral, insurance, taxation etc.

\(^1\) National Land Survey of Sweden, 2012
\(^2\) Statistics Sweden, 2012
\(^3\) Statistics Estonia, 2012
Timberland valuation has been researched for over two centuries and there is a comprehensive amount of scientific articles concerning timberland and forest appraisal. Although timberland valuation is well-founded in theory, it is often rather different in practice.

(Wagnière, 2011) highlights that the consistency of timberland valuation practices are, to a great extent, influenced by information, cost and time restrictions. Furthermore, existing international valuation standards, which act as an umbrella for worldwide standards, contain vague guidance concerning timberland property valuations. Consequently, there is a lot of confusion and disagreement around timberland appraisal. International Valuation Standard Council (IVSC) points out in (The International Valuation Standards Council IVCS, 2011) that areas of disagreement and diversity are the discount rate, the treatment of land value, establishing the maturity age of trees, log price assumptions, etc. Furthermore, PricewaterhouseCoopers made an exclusive study (PricewaterhouseCoopers, 2009) concerning the IAS 41 and concluded that further improvements, with regard to the level of the transparency of critical valuation assumptions, should be carried out.

(Viitanen, Hannelius, & Airaksinen, 2006) argues that in order for global capital transfers to be free and unrestricted, the decision makers must have reliable and comparable value estimations. (Viitanen, Hannelius, & Airaksinen, 2006) opinion is that forest properties should have completely independent and specified valuation guidance, since there are not enough instructions about valuing forest properties in terms of present valuation standards.

(French N. , 2005) discusses that countries or regions can have very different cultures and knowledge, consequently, the methods used for appraisal are also diverse. (Binkley, 2009) points out that the timberland valuation approaches are generally different in emerging markets and developed countries.

1.2 Problem area and research question

Although scientific theory regarding timberland valuations is sufficient and thorough, adapting the valuation theory in practice depends substantially on the way it is regarded in the valuation standards. Contemporary international valuation standards comprehend very little guidance regarding timberland appraisal and thus there exists confusion and disagreement in this area (Viitanen, Hannelius, & Airaksinen, 2006; The International Valuation Standards Council IVCS, 2011).
A global study done among 19 different companies shows that the main valuation approaches used by these companies are similar, however, the companies are using different methods to determine the key assumptions in valuation approaches (PricewaterhouseCoopers, 2009). The phenomenon that countries and regions can have differences in valuation practices is also brought out in (French N., 2005).

The object of interest in this thesis is therefore; how timberland market value is appraised in Estonia and Sweden? This is also the main research question of this thesis. Several sub-questions need to be answered in order to answer the main question and these are identified as follows:

- What is the main purpose of appraising timberland?
- What valuation methods are used for appraising timberland?
- How is the income approach implemented?
- How is the comparable sales approach implemented?
- How is the cost approach implemented?
- How is the uncertainty of market value handled and reported?

### 1.3 Research limitations

The thesis is geographically limited to Estonia and Sweden, timberland valuation practices in other countries may or may not be similar. This study focuses only on timberland appraisal and does not investigate how the forest inventory data is collected. Also, this study covers only the topic of timberland market value estimation and does not consider other types of value estimates.

### 1.4 Relevance

To our knowledge, this is the first study of the timberland appraisal practices in Estonia and Sweden. This thesis will add knowledge to participants, such as appraisers, timberland owners, investors and policy makers, regarding the methods, techniques and assumptions used in timberland appraisal in Estonia and Sweden.
1.5 Report structure

The thesis is organized into six subsequent chapters. The next chapter provides an overview of the methodology that is used to study the research questions. It will be followed by an overview of basic forestry and forest economics, which are necessary to know in the following chapters. Chapter 4 will examine current scientific theory about timberland appraisal. Chapters 5 and 6 will present and analyse the findings from the empirical study. The last chapter will answer the research questions and conclude the thesis.
2. Methodology

2.1 Approach

The thesis is designed as exploratory research merely because no earlier studies were found that could be used as references to information for answering the research questions. The best approach for answering the research question is a qualitative method. It is explorative by nature and gives a good understanding about the appraisers’ process of reaching to timberland value estimation. Interviews are held with appraisers in Estonia and Sweden in order to capture their deeper knowledge, experience, justifications and beliefs about the process of valuing timberland. The study used in this thesis is called a comparative case study, in which the same questions are asked from a number of appraisers. The collected data is then analysed and compared in order to reach to a conclusion concerning the research questions.

2.2 Sources of data

This study uses primary as well as secondary data sources for answering the research questions and preparing the report. Primary data is used because the study is explorative and there is not enough secondary data to answer the research questions. Secondary data is used to establish the theoretical framework of the thesis.

The primary data comes from interviewing companies that appraise timberland in Estonia and Sweden. Interviewing was chosen in order to capture appraisers’ deeper knowledge, experience, justifications and beliefs, which is not easy to do through other forms of primary data collection, i.e. questionnaires. The interviews were conducted face-to-face, on the phone or on Skype. Some specifications were made later via e-mail. The total population consists of all the companies that appraise timberland in Estonia and Sweden. The sample of the total population is selected based upon a judgment sample, i.e. companies that were thought of being representative of the population were selected.

Like previously mentioned, secondary data is used to establish the theoretical framework of the thesis. The secondary data comes from scientific articles, doctoral theses, research reports, internet resources, etc.
2.3 Conceptual framework

The theoretical section will be based on secondary data regarding the forestry, forest economics and timberland valuation. Forestry and forest economics are mainly discussed for supporting the reader’s comprehension of the timberland valuation chapter, as well as the empirical chapter and conclusions.

The aim of the theoretical section is to provide the basic framework for the empirical and analytical section as well as to give an overview of the scientific perspective. The theoretical section and the results from the empirical section will be analysed in order to answer the research questions.
3. Basics of Forestry and Forest Economics

Forestry deals with managing, using, conserving, and creating forests and related resources for human benefit. Forest economics focuses on the consumption, distribution, and production of forest products and services. (The Society of American Foresters, 2012)

An elementary understanding of forestry and forest economics is necessary for appraisers in order to understand how timber value affects the timberland value. This chapter serves to give an overview of forestry and forest economics related to the timberland appraisal which is necessary to understand the timberland valuation theory in Chapter 4.

3.1 Forest inventory

Forest inventory or timber cruise can be considered as a starting point of timberland valuation. Without an accurate forest inventory an appraiser cannot estimate the value of timber and since timber value usually makes the most of timberland value, an appraiser cannot reach to the conclusion of timberland value without it. (Husch, Miller, & Beers, 1982) has defined forest inventory as follows:

“A forest inventory is the procedure for obtaining information on the quantity and quality of the forest resource and many characteristics of the land area on which the trees are growing. A complete forest inventory for timber evaluation provides the following information: estimates of area, description of topography, ownership patterns, accessibility, transportation facilities, estimates of timber quantity and quality, and estimates of growth and drain.”

(Mellette, 2008) discusses different methods of how the forest inventory is executed, some approaches only investigate a sample of the timberland (i.e. fixed-plot method, including strip method and variable radius method), while others demand going through the whole forest and measuring every single tree on the property. The latter is called a complete cruise or a 100% cruise; it is not very popular and it is usually done when dealing with very high value timber on a small property. The complete cruise is very precise but costly to perform. Sample approaches are less expensive but also less accurate. Nevertheless, in a sample approach accuracy can be improved by increasing the number of samples. The level of accuracy or the confidence interval is to be stated by the appraiser. Based on the accuracy requirements the forester decides upon the number of samples that satisfy the requirements. Sample approaches are generally more common in forestry.
Forest inventory information is particularly important for timberland valuation. Forest management plans, discussed in Section 3.2, are also based on the forest inventory.

### 3.2 Forest management basics

Forest management has a huge effect on tree growth, timber quality, and the composition of tree species. Furthermore, forest management has a direct effect on timber value (Mellette, 2008). A study (Stora Enso Mets, 2005) made in Estonia showed that managed forest 80 years’ rotation net income is approximately 2.2 times higher than the unmanaged forest net income. Furthermore, (Stora Enso Mets, 2005) states that forest management costs can be seen as an investment that yields approximately 3.5% interest per annum.

Forest management is defined by (The Society of American Foresters, 2012) as “the practical application of biological, physical, quantitative, managerial, economic, social, and policy principles to the regeneration, management, utilization, and conservation of forests to meet specified goals and objectives while maintaining the productivity of the forest“.

Forest is managed on a stand basis, (The Society of American Foresters, 2012) defines stand as “a contiguous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit“. The forest inventory, discussed in the previous section, is also usually made per-stand basis. According to (Mellette, 2008) large timberland properties usually contain several stands while smaller properties could only consist of one stand. The way stands are divided depends specifically on forest management and the landowner’s objectives.

Forest management is done according to a forest management plan, which is usually conducted for 10 years. Forest management plan includes information about soils, logging methods, disease or insect problems, road conditions, growth and age data, environmental concerns, etc. Recommended silvicultural treatments and their timing, as well as the timber cruise information discussed in previous section, are also part of a forest management plan.

### 3.3 The value of timber

Interactions between the timber supply and demand determine the strength of the timber market at any given time, which in turn set the timber prices. The timber supply is the total quantity of raw material, pulpwood or sawtimber supplied per period in a market with different prices (Pearse, 1992). The timber supply is critically dependent on weather. During
wet winter periods timber supply is limited because of the disturbances in harvesting. Conversely, during the dry period’s mill inventories usually fill up because of good harvesting conditions (Mellette, 2008). The timber demand is driven by the demand for goods made from wood. These are, for example, housing, toilet paper, furniture, windows, newspapers, firewood and etc. The sum of demand for all the products made from wood is the total demand for timber (Pearse, 1992).

At a fundamental level the price of timber is determined by supply and demand. In a competitive free market, supply and demand form the equilibrium price. The equilibrium means that in case of a perfect competition supply equals demand. While in the short term, supply might not equal demand, in the long term the market will always move towards equilibrium (Pearse, 1992).

Nevertheless, some of the aspects of timber, land and sale itself also influence the price of the timber. (Mellette, 2008) points out three different categories that the unit rates of timber depend on:

- The characteristics of the timber
- The characteristics of plot
- The sale conditions

Each category consists of several independent factors. The characteristics of timber that influence the price are, for example, volume, size, frequency of limbs and knots, quality. Access, location, logging possibilities, and other characteristics related to the plot also influence the unit price. The unit price is also affected by the surrounding sale conditions, where the bidding activity, buyer and seller motivation, payment form and other factors are important.

3.4 Timber price information

There are three main sources for timber price information: comparable timber sales, timber price reporting services and delivered log prices. The most reliable source is generally the comparable timber sales information. (Mellette, 2008)

Comparable timber sales information can be acquired from consulting foresters. Since consultants are usually the ones who manage timber sales, they are constantly informed about
the prices. Furthermore, (Mellette, 2008) argues that the best indication for timber value can be extracted from sealed-bid clear-cut timber sales. Authors point out that sealed-bid sales are typically between knowledgeable and willing parties and are mostly competitive by nature. A good timber price indication would be a sale in the case of which there is more than one bid and the gap between the first and the second bid is small.

There exist plenty of published timber price information sources. The author advises to rely on the data reported by sellers rather than the one reported by buyers, since buyers are motivated to understate timber prices. (Mellette, 2008)

The timber sales price paid by forest products companies and mills is also a potential source of stumpage price information according to (Mellette, 2008). However, the author warns that these prices fluctuate greatly with the lumber markets and mill inventories. Additionally, the appraiser must deduct cutting and hauling costs as well as the timber buyer profit from the delivered log prices in order to get the stumpage price. Cutting costs, hauling costs and buyer’s profit, though, are hard to obtain.

3.5 Present value & future value
Forestry requires large scale investments and is considered to be a capital intensive industry. Moreover, timber production periods (or rotations) are particularly long, in some cases reaching up to hundred and more years.\(^4\) (Niskanen, et al., 2002) explains that profits in forestry would seem very high if all the expenses and incomes were summed up without considering the time differences between occurrences. Future cash flows must be converted or discounted to present before comparison with present values is possible.

\[
\text{present value} = \frac{\text{future value}}{(1 + \text{interest rate})^{\text{time}}} = \text{future value} (1 + \text{interest rate})^{-\text{time}}
\]

*Equation 1. Present value calculation* (Saastamoinen & Matero, 2012)

Converting future cash flows to present is done with the help of discount rate. Discount rate has a very important role in present value calculations, since it influences the present value to a great extent. For example, the investors’ interest is to earn more money from a particular

\(^4\) See more information about optimal rotations in Section 3.7
project than they initially invested. Essentially, investors hand over the opportunity to use money at the present and demand extra money for that, called interest or rate of return.\(^5\)

### 3.6 Capital budgeting

In the field of forestry, capital budgeting is all about deciding how to maximize the value of the invested money. This is generally done by comparing investment opportunities and choosing the most profitable one. In order to do that, it is important to predict all the revenues and costs according to their occurrence in time along with the interest rate that will be used to discount these cash flows. There are several criteria for determining the best investment decisions and three of them will be introduced as follows.

#### 3.6.1 Net present value

All the revenues and costs are discounted separately to the present time. After that these values are summed up to the net present value (NPV).

\[
\text{Net present value} = \sum_{\text{time}=0}^{\text{end year}} \left[ \frac{\text{Revenue}_{\text{time}}}{(1+\text{discount rate})^{\text{time}}} - \frac{\text{Cost}_{\text{time}}}{(1+\text{discount rate})^{\text{time}}} \right]
\]

*Equation 2. Net present value calculation* (Saastamoinen & Matero, 2012)

The rule of thumb is that if NPV is equal or greater than “zero”, then this investment will be acceptable for the investor. Investment calculations with NPV less than “zero” should be rejected. When comparing investment opportunities, the highest NPV investment is also the most profitable one.

#### 3.6.2 Benefit / cost ratio

Benefit/cost ratio is the ratio between the discounted revenues and costs. Essentially, if the present value of the revenues is higher than the present value of the costs, then the ratio is greater than 1, which allows assuming that this investment opportunity could be acceptable.

#### 3.6.3 Internal rate of return

\[
\sum_{\text{time}=0}^{\text{end year}} \left[ \frac{\text{Revenue}_{\text{time}}}{(1+\text{internal rate of return})^{\text{time}}} - \frac{\text{Cost}_{\text{time}}}{(1+\text{internal rate of return})^{\text{time}}} \right] = 0
\]

*Equation 3. IRR calculation* (Saastamoinen & Matero, 2012)

\(^5\) See more information about discount rates in Section 4.2.2
Internal rate of return (IRR) is a discount rate of a project where the difference of the present value of revenues and costs equals “zero”. IRR could be considered as the lowest acceptable rate of return for an investment to be profitable.

All these three criteria are very closely linked. If IRR is less than the discount rate, the NPV is negative and B/C is below one, the investment opportunity is rejected by any of the criteria. Conversely, if the discount rate is below IRR, NPV is zero or positive and B/C is more than 1, the investment is accepted. Nevertheless, if investment opportunities are ranked using different criteria, the ordering is not always the same. Some projects might have zero NPV at more than one discount rate value. (Pearse, 1992)

3.7 Optimal rotation age

Rotation is the period between regeneration and the final cutting. Optimal rotation age, from an economical perspective, is the rotation duration at which the revenue or yield generated from the stumpage is maximized. Rotation age is an input in many timberland valuation models. The following part will go more into detail in determining the optimal rotation age.

Tree volume growth follows the sigmoid curve as it is shown on Graph 1. Initial growth, when the stand is young, is slow and is followed by a rapid increase in timber volume up to the financial maturity when the growth slows down. Current annual increment (CAI), which is the amount of timber added annually per hectare, starts to drop after the optimal harvest age, as it is shown on Graph 2. Graph 3 describes the phenomenon that the relative growth rate is the highest in the beginning and decreases as timber
matures. There has been a lot of arguing about what criteria should be used in optimal forest rotation determination (e.g. Möhring, 2001; Hyytiäinen & Tahvonen, 2003; Viitala, 2006).

(Nautiyal, 1988) states that maximum sustained yield is the most common criteria to use because of its simplicity and because it leads to maximum average volume production per year, which also means that the site is used in the best way. The maximum sustained yield (MSY) criteria used for determining the optimal harvesting age for timber is especially popular among biologists. MSY function does not include any monetary units like stumpage prices or discount rates. It simply tries to maximize the MSY:

\[
\text{Maximize MSY} = \frac{\text{volume of timber at harvest age}}{\text{harvest age}}
\]

Equation 4. Maximum sustained yield calculation (Saastamoinen & Matero, 2012)

According to the MSY approach, timber should be harvested when current annual increment (CAI) equals the mean annual increment (MAI). That is shown on Graph 4.

As mentioned earlier, the MSY approach is fully independent from income and discount rates; subsequently, there is no economical rational behind that approach. The MSY approach is not built upon economic efficiency but sustainability.

Nevertheless, there is another approach that is built upon economic efficiency. It is called the forest rent approach (FR). The idea of the FR is to maximize the average annual net income or forest rent. Thus, the FR criteria is:

\[
\text{Max Forest rent} = \frac{[\text{cutting revenue at harvest age - planting costs}]}{\text{harvest age}}
\]

Equation 5. Maximum forest rent calculation (Saastamoinen & Matero, 2012)
Optimum rotation with the FR approach is geometrically shown on Graph 5. With the FR the rotations are always longer than with the MSY approach because it takes into account the planting costs.

The forest rent approach is very similar to the Faustmann Model or the Land Rent theory of determining the rotation age. Actually, the forest rent approach is same as the land rent theory with zero interest rate. Basically, what the Faustmann Model is all about is that (Faustmann, 1849) proved that the forest value is a sum of discounted net cash flow during the infinite time period. If everything else is fixed, the rotation must be chosen so that the forest value is maximized.

The Faustmann Model can be interpreted as follows: if the marginal cost of delaying clear-cut is equal to the marginal advantage from suspending clear-cut, then it is best to cut a stand.

The cutting ages are determined by the forest law that enacts the rules when timber can be harvested, which is similar in Estonia and Sweden. For example, the Estonian Forest Law stipulates cutting ages for different tree species according to the diameter or age of the stand described in Forest Management Guidelines. The crop is ready for harvesting when either the age or the diameter has reached to the specified.

The financial maturity of a particular stand could occur prior to the cutting ages determined by the Estonian Forest Law; however, a stand cannot be cleared before reaching to the age stipulated in the law. Allan Sims revealed that there is not enough material to prove that financial maturity could appear prior to the cutting age determined by the Forest Law. He further explained that the financial maturity depends on several factors, including changing timber prices, dominant species and price differences between different species.

Equation 6. Soil expectation value calculation (Saastamoinen & Matero, 2012)

\[
\text{soil expectation value} = \frac{\text{cutting value at harvest age} - \text{planting costs}}{(1+\text{discount rate})^{\text{harvest age}}} \cdot \frac{1}{(1+\text{discount rate})^{\text{harvest age}} - 1}
\]
4. Timberland Valuation Theory

Previous chapter discussed several insights of forestry and forest economics. These are important to understand before reading this chapter.

This chapter serves to provide an overview of the scientific theory behind the timberland valuation. The first section of this chapter discusses the purpose of timberland valuation and valuation definitions. The second section provides an overview of timberland valuation methods, including the income approach, the comparable sales approach and the cost approach. Last section discusses uncertainties related to timberland valuations.

4.1 Purpose of valuation and valuation definitions

According to (Appraisal Institute, 2008) real property is defined as all the interests, rights, benefits and encumbrances that go together with the ownership of real estate. Real estate, however, is defined as the land together with the natural part of the land (i.e. trees, minerals, etc.), all man-made things attached to the land (i.e. buildings, site improvements, etc.) and all permanent building attachments along with built-in items (i.e. plumbing, heating systems, elevators, etc.). Appraisal is merely an act or a process of developing value estimation. Hence, the real estate appraisal must assess the value of the benefits and liabilities that the real estate possesses.

The most widespread purpose for an appraisal is to determine the market value of the property for a potential purchase or sale. Nevertheless, there are many other situations that may call for an appraisal, for example, exchange, taxation, gifting, partial taking, etc. For an appraisal to be convenient it has to estimate the market price of the property accurately. Thus, the valuation model has to reflect market conditions, culture and also represent the market fundamentals. (Pagourtzi, Assimakopoulos, Hatzichristos, & French, 2003)

In the real estate market, valuation is often meant to be an estimation of the trading price of a property. Price in this context is considered as the actual price that the property was transacted for and market value is merely an estimation of that price. Worth is the value for the individual or group of individuals. Namely, the inherent value for different groups can be different. For the investor the property is more or less the discounted value of produced cash flows, but for the owner-occupier the asset has a somewhat different value. Nonetheless, both these groups probably take into consideration the resale price to a purchaser that could be
from another group entirely. These different interests among purchasers certainly inject a lot of confusion to the market and make it difficult for the appraisers to arrive at a market value conclusion. (Pagourtzi, Assimakopoulos, Hatzichristos, & French, 2003)

In order to elucidate the assumptions made in property appraisal the value that is estimated is defined in the valuation report. Another important reason for defining the market value is to ensure uniformity in the valuation process. One of the most popular market value definition that is used in property valuations is proposed by the International Valuation Standards Committee (IVSC):

“Market value is the estimated amount for which an asset should exchange on the date of valuation between a willing buyer and a willing seller in an arm’s length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently and without compulsion.”

Despite being the most popular and broadly held market value definition, it’s definitely far from being perfect. (Lind, 1998) presents a very in-depth analysis about the market value definition. The author concludes that the market value definition should not encompass the knowledge and prudence of the buyers and the sellers, mainly because it makes the definition irrelevant for a market with a broad and heterogeneous agent base. Also, the definition should not be concerned about the willingness of the buyer and the seller, since these terms are useless in the case of the proper marketing. Furthermore, (Lind, 1998) states that in case of very unique properties, on thin markets, the appraiser might not be able to make a market value statement at all. If it is impossible to state the market value, the appraiser should present all the evidence and the actors of the market should draw a conclusion of the value themselves.

4.2 Valuation approaches

4.2.1 Different approaches to value

The best or the right valuation method does not exist, different circumstances demand different valuation approaches. Even though one valuation approach is sometimes more suitable than others, mathematical accuracy is not always equal to superiority. Furthermore, countries or regions can have very different cultures and knowledge. Consequently, the methods used for appraisal are also diverse. It is generally up to an appraiser to decide which
Several appraisal approaches are discussed and analysed in timberland valuation literature. Three of the most prominent approaches are the income approach, the sales comparison approach and the cost approach.

### 4.2.2 The income approach

Timberland properties are generally purchased as an investment and therefore the capability of the properties to produce income is critical for an investor or an owner. For an investor, provided that risk is constant, higher earnings mean higher value. Hence, an investor purchasing a timberland property is virtually trading present money for the hope of receiving more money in the future. The appraiser analyses the benefits that the property generates and then uses the income approach procedures to convert the benefits into a present value indication. (Geltner, Miller, Clayton, & Eichholtz, 2007)

According to (Kobriger, Boone, Weiss, & Chambers, 2011), the income approach is a very trustworthy method for timberland appraisal and also the primary valuation technique in timberland appraisal. (Kobriger, Boone, Weiss, & Chambers, 2011) discusses that diversifying real estate investment portfolios with timberland investments has become very popular and therefore, the level of experience, knowledge and sophistication regarding the income approach has developed considerably during the previous decade.

(Straka & Bullard, 1996) explains that the income approach is based on the net present value (NPV) calculation. The main income approach used in forestry and timberland investment is called the land expectation value (LEV) method. LEV is used to assess the value of bare forest land, but also to choose from various forest management alternatives as well as to determine the rotation age of a certain forest. (Measells & Henderson, 2009) defines LEV as the investor’s maximum willingness to pay for bare land while still being able to earn the rate of return equal to the discount rate used in the calculation. LEV uses the NPV of the incomes and costs related to the timber production. LEV is not an ordinary discounted cash flow analysis, because the timber is growing to perpetuity, not just for a fixed number of years or

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8 See more information about optimal rotations in Section 3.7
one rotation. LEV assumes that at the start there is only bare land, therefore it is sometimes said to be bare land value or soil expectation value.

The LEV technique was first published in (Faustmann, 1849) by a German appraiser Martin Faustmann who used the method to assess the value of timberland for taxation purposes.

LEV is based on the standard perpetual periodic annuity discounting formula shown on Equation 7. According to (Straka T. J., 2007) it is basically a standard DCF approach with some assumptions:

- Income and costs are the same for all the rotations.
- All incomes and costs are converted to the end of the rotation and regarded as a single value at the end of each rotation.
- There are an infinite number of rotations.
- Each rotation will start with regeneration costs.
- Land value is not an input in a calculation.

**Valuing timberland with even-aged trees**

(Straka & Bullard, 1996) explains that the ideal situation for the LEV formula is if timberland has forest with even-aged trees. Furthermore, (Straka & Bullard, 1996) provide three steps regarding the basics of what the LEV calculation consists of when dealing with timberland property that has even aged trees on it:

- The first step is to determine all the cash flows associated with one rotation. These cash flows comprise initial costs (planting, site preparation, etc.), subsequent costs (thinning costs, disinfestation, property tax, etc.) as well as revenues during the rotation (thinning incomes, final harvest income, etc.).
- The second step is to calculate the future values of these cash flows at the end of the rotation and then add them together to get the net future value with the formula shown on Equation 9.
- The third step is to use the perpetual periodic series present value formula shown on Equation 8 to calculate the LEV.
The calculated value is for the bare land, meaning that it does not take into account the existing timber (i.e. merchantable timber, premerchantable timber and logging debris). The LEV is calculated in real terms and it can also make allowances for the real price increase. The geometric series cash flow formula has to be used instead of the perpetual periodic series formula in order to account for the real price increase. The annual increase in NFV has to be less than the discount rate, otherwise the LEV will move towards infinity. (Straka T. J., 2007)

**Valuing immature timber**

(Straka & Bullard, 1996) and (Straka T. J., 2007) both recommend a technique how LEV can be used to value timberland with immature even-aged forest on it. Valuing timberland properties with immature or pre-commercial timber is somewhat complicated, as the timber cannot be converted into timber products. Immature timber can be valued by discounting future timber harvesting cash flows to present. The value of immature timber is calculated with the formula shown on Equation 10. Pre-commercial timber value consists of the discounted net value of the cash flows associated with the immature timber (NV) and the discounted LEV. LEV has to be discounted because the harvesting of the following full rotations will be delayed (cash flows from subsequent harvestings will be delayed t years). The formula works as follows. The net value of the period m to t (NV in the formula) and net value of the period t to infinity (LEV) will be summed and then discounted to year m. This gives the value of the bare land plus the immature timber on it. LEV is then subtracted to get the immature timber value.
Valuing timberland with uneven-aged forest

Land expectation value (LEV) can also be used to value uneven-aged forest tracts as stated by (Straka & Bullard, 1996). Trees that have reached maturity are usually harvested within a certain cycle. The tract could be harvested either annually or after every c years. According to (Straka T. J., 2007), it is not possible to separate the land value and the timber value from the total timberland value in the case of uneven-aged forest tracts. If the tract is not clear-cut, bare land cannot exist on uneven-aged timberland property. (Straka & Bullard, 1996) states that it is very easy to calculate LEV if trees are harvested annually. In that case, LEV equals to the net annual income divided by the interest rate shown on Equation 11.

If the trees are harvested over a certain period of time, e.g. 2 years or 5 years, then the standard LEV calculation is also suitable. The time periods between cycles are called cutting cycles and the forest that is not cut is called a reserve stock. The part that grows over the cutting cycle, in excess to the reserve stock, will be cut periodically. LEV is calculated by subtracting the annual management and property tax costs from the net timber revenue with the help of the future value annuity formula, which is shown on Equation 12. As with yearly cutting cycles, the land value and timber value cannot be separated. The timberland property can be seen more as a production entity.

Discounting

The land expectation value (LEV) method has discount rates in the numerators on the right hand side of the equation. These discount rates are the investor’s long term dollar-weighted average expected returns in the form of going in internal rate of return (IRR)\(^9\). Despite the fact that the LEV method has several inputs, only the discount rate will be discussed in this study. The motives for the latter are:

\(^9\) See Section 3.6.3 for detailed information about IRR calculation
• There is a lot of confusion around estimating and understanding the discount rates, but not so much about other inputs.
• There is plenty of scientific literature concerning discount rates, but not so much about other inputs.
• The discount rate has a substantial influence on the value estimate in comparison to other inputs.

The Discount Rate
The discount rate consists of the risk free rate and the risk premium, as shown on Equation 13. The risk premium has to reflect the risk that is associated with the cash flows that are discounted. The risk free rate reflects the rate of return of an investment that carries no risk of financial loss. The discount rate is meant to be the opportunity cost of capital (OCC) for the subject investment. Other investments with a similar risk have the same risk premium and therefore the same discount rate. It is the rate of return that is required by the investor to be willing to make the investment and take the risk.

\[
\text{Risk Free Rate} + \text{Risk Premium} = \text{Discount rate}
\]

Equation 13. The discount rate

Determining the discount rate
(French & Gabrielli, 2004) states that the appraiser usually obtains the view of the appropriate discount rate by analysing comparable sales. This could be done by running the land expectation value (LEV) method backwards or perhaps building a regression model to determine the appropriate discount rate. Nevertheless, (Lorenz, Trück, & Lützkendorf, 2006) argues that while the rent levels and selling prices of the properties are more or less obtainable everywhere, the yields of comparable sales are not. Therefore, if the appraiser does not reach to a decision about discount rate by studying the comparable sales, it is recommended that the appraiser takes another approach, which is to determine a discount rate by adding risk premium to the risk free rate.
That raises the issue of how to determine the risk free rate and risk premium. (Lorenz, Trück, & Lützkendorf, 2006) and (Adair & Hutchison, 2005) both complain that there is very little guidance about how to determine discount rates and the process is very subjective.

Determining the risk-free component is somewhat simpler and more objective than determining the risk premium. If the investment would be short-term by nature, the obvious reference would be the current short maturity government bond yield. Investments in short maturity government bonds do not carry essentially any default risk or interest rate risk. Nevertheless, real estate investments and especially timberland investments are predominantly long-term by nature. There might be up to a hundred years between the initial investment and harvesting. Therefore discount rates have a paramount importance in timberland appraisal. Using current short-term government bond yields in long DCF models is not correct, because short-term yields could be highly affected by current market conditions, government monetary policies, short-term money supply and demand. It would be appropriate to use average short maturity bond yield instead of the current short maturity bond yield. One proxy to average short-term government bond yield is to take a long-term government bond current yield, for example a ten year government bond current yield. However, it must be considered that investments in long-term government bonds are not completely riskless. Namely, long-term government bond yields carry some risk premium in them. Therefore, the current yield of the long-term government bond must be decreased by the average difference between the long-term and short-term government dept. That difference is usually 1% to 2%, meaning that if the ten year government bond current yield would be 5%, the risk-free rate used in the discount rate should be around 3.5%. (Geltner, Miller, Clayton, & Eichholtz, 2007)

Determining the risk premium is quite subjective by nature. Different types of investments are highly integrated in a sense that if one type of investment offers a better risk premium than the other, and the risk is equal, the investor chooses the one with the higher premium. Due to the integration it is necessary to empirically monitor the typical return rates from various types of investments and also to make some judgements about the risk in a subject property compared to these observable investments. The ones that provide all the necessary information are stock and bond markets and as real estate is also part of the same investment universe, bond and stock returns are very useful in determining the return expectations for real estate investments.
Historical return trends reveal that, in terms of risk, capital markets place real estate between stocks and government bonds. (Geltner, Miller, Clayton, & Eichholtz, 2007)

An additional approach is to use the models of risk and return that are common in finance. (Lorenz, Trück, & Lützkendorf, 2006) concludes that the most known models are the capital asset pricing model (CAPM), the multi-factor model (MFM) and the arbitrage pricing model (APM). All these models share a common trait: the expected return of any investment is a sum of risk-free rate and risk premium. Furthermore, all of them are based on the idea that riskier investments should provide a higher return than safer investments.

4.2.3 The sales comparison approach

According to (Appraisal Institute, 2008), the sales comparison approach is a valuation method, in which the subject property value estimation is established by analysing earlier transactions, pending sales, or listings that are similar to the subject property. (Pagourtzi, Assimakopoulos, Hatzichristos, & French, 2003) explains that the comparable sale approach relies on the assumption that the value of the subject property is close to the transaction prices of the comparable properties.

(Pagourtzi, Assimakopoulos, Hatzichristos, & French, 2003) describes the comparable sales process in the following way. The appraiser selects similar properties from recently conducted transactions. As two properties are virtually never identical, appraisers must adjust the transaction prices of comparable transactions in order to account for the differences between the subject property and the comparable sales. Comparable sales that need less adjustment will have bigger weight in estimating the market value for the subject property. Finally, based on the adjusted prices of comparable sales, the appraiser reaches to the market value estimation of the subject property.

Based on the latter, four steps can be identified in the comparable sales approach:

- Finding the comparable sales
- Adjusting the comparable sales
- Arriving to a subject property market value estimation
- Presenting the results
The sales comparison approach relies to a great extent on the accessibility, correctness, comprehensiveness, and suitability of transaction data. That is also one of the main reasons why the sales comparison approach is problematic to use in timberland appraisals. Moreover, when it comes to timberland appraisal, the absence of uniform adjustment process makes it complicated to use the sales comparison approach. (Pagourtzi, Assimakopoulos, Hatzichristos, & French, 2003)

According to (Pagourtzi, Assimakopoulos, Hatzichristos, & French, 2003), when considering real estate valuation in general, the sales comparison approach is the most used valuation approach. However, (Healy Jr. & Bergquist, 1994) states that the comparable sale approach is considered to be a secondary appraisal method after the land expectation value method in timberland appraisal.

(Healy Jr. & Bergquist, 1994) point out three instances when the comparable sales approach could be helpful in valuing timberland: when comparable sales are conducted recently, when big tree farms with more than 5,000 acres and with multi-aged timber are valued, and in case the timber is very young.

**Comparable Sale Adjustments**

While one cannot do much about the difficulties related to the amount of comparable sales, there is a lot one can do about making the ones that are available more comparable to the subject.

(Appraisal Institute, 2008) divides adjustments into two: transactional adjustments and property adjustments. Transactional adjustments, for example, are sale conditions (i.e. motivation), market conditions (i.e. time) and real property rights conveyed. Property adjustments, for instance, are location, physical characteristics, economic characteristics and use. (American Society of Farm Managers and Rural Appraisers ASFMRA, 2004), (Mellette, 2008), (Association of Consulting Foresters of Australia, 2009) and (Healy Jr. & Bergquist, 1994) all agree that the following characteristics of transactions should be adjusted: market conditions, volume of timber per hectare, species mix, transaction quality, age of the timber, timber quality, and site features. Nevertheless, there are some characteristics that each article suggests to adjust additionally. For example, (American Society of Farm Managers and Rural Appraisers ASFMRA, 2004), (Mellette, 2008) and (Association of Consulting Foresters of
Australia, 2009) all recommend to adjust transactions for distance from mills. (American Society of Farm Managers and Rural Appraisers ASFMRA, 2004) and (Mellette, 2008) both recommend to adjust transactions for total size of the sale. The complete list of characteristics that is recommended to adjust is as follows:

- Real property rights conveyed
- Sale conditions or transaction quality
- Market conditions or time
- Volume of timber per hectare
- Species mix
- Timber quality
- Age of the timber
- Site features
- Total size of the tract

**Real property rights conveyed**

(Appraisal Institute, 2008) emphasize that quite often when property is sold it is subject in some contract which influences the real property rights. In order to use the comparable property in a sales comparison analysis, the appraiser must make sure that the price of the comparable property incorporates the same real property rights than the subject property. If the real property rights of the comparable differ from the subject, the appraiser has to adjust the price before the comparison.

(Appraisal Institute, 2008) explains that if the property is subject to an existing lease, the owner does not control the complete bundle of rights that the property incorporates. Therefore, if a leased property transaction is being used in a comparable sales analysis to estimate the value of the fee simple interest in a subject property, it has to be adjusted. The comparable sale price is adjusted by the total difference between the market net rent and the contractual net rent, subtracting the market vacancy and discounting it to the present. The value of the lease could be either negative or positive, depending on the contractual rent level compared to the market rent level.
Sale conditions
According to (Appraisal Institute, 2008), the sale conditions adjustment generally reflects the buyers or sellers motivation to close the deal because of duress. These conditions can influence the transaction price significantly and transactions conducted under duress are not considered as arm’s-length transactions. (Mellette, 2008) argues that transaction quality adjustments are subjective and based on the appraisers opinion. There are several factors that an appraiser could take into account while adjusting sales comparatives for transaction quality. The most important factors to consider are the number of bids, buyer and seller knowledge and motivation, bid results, adequacy of time allotted, involvement of a middleman and the form of payment.

Market conditions
As mentioned previously, to increase the amount of comparative sales transactions one might sometimes have to reach quite far back in time. (California State Board of Equalization, 2007) explains that older sales need adjustment in prices to make transactions comparable with the subject in terms of market conditions. The logic behind this adjustment is that the appraiser needs to decide the comparative sales transaction price if the property would sell on an appraisal date instead of the day it was truly transacted.

Time adjustments are usually made with the help of market data (i.e. stumpage values, indexes for timberland values, etc.). If there is a big gap between older comparative prices and newer ones, appraisers usually give bigger weight to the newer transactions. Appraisers should keep in mind that market data is usually generalized and therefore it does not reveal differences in log sorts and other aspects that influence individual property values. (Healy Jr. & Bergquist, 1994)

Volume adjustments
The second component should be adjusted in the comparative sales analysis is the timber volume per hectare. The subject property volume is set as a benchmark and comparable sales prices will be adjusted according to the difference between volumes per hectare. The logic behind this adjustment is that, other things being equal, a higher timber volume per hectare sells for a greater price. Obtaining comparable sales data, in which volumes are similar, is very difficult; therefore, huge variation in volume per hectare and extensive adjustments are not unusual. (Healy Jr. & Bergquist, 1994)
Species mix adjustment

Timberland values are influenced by the tree species that grow on it. This is because trees of the same age but from different species have very different stumpage values. According to (Estonian University of Life Sciences, Institute of Forestry and Rural Engineering, 2011) difference could be more than 40% in delivered stumpage value. In order to adjust the difference one needs to know the percentages of the proportions of tree species in each comparable as well as in the subject timberland property. By multiplying the percentages of the proportions of each species with its delivered stumpage value and summing the share amounts, the appraiser will have weighted delivered stumpage value. Finding the percentage differences between the subject and the comparable allows capturing the appropriate amount of adjustment. (Healy Jr. & Bergquist, 1994)

Timber quality adjustment

Timber quality also plays an important role in determining the value of the timberland. If the appraiser has a timber cruise data for every comparable and subject timberland, it is possible to adjust the comparable sales. The adjusting is somewhat similar to the adjustments done in the species mix but a little more sophisticated. Timber quality adjustments are done by calculating average merchantable timber values per square meter while taking into account all the different timber grades and species. The average merchantable timber value of the subject property is taken as a benchmark and comparable sales are adjusted accordingly. (Healy Jr. & Bergquist, 1994)

Timber age adjustment

The value of the timberland property is affected by the age of the timber on it. Merchantable timber has a higher value than premerchantable timber and reprod timber. Therefore, appraisers need to adjust the sale comparable if there is a big difference in the share amounts of different age classes.

In timber age adjustments, the timber is usually divided into three age classes: reprod timber, premerchantable timber and merchantable timber. Age adjustments are done with the help of per hectare volumes, the share amounts of different age classes, and the values of the different age classes. This method is somewhat complicated since the values of premerchantable and reprod timber cannot be readily obtained like merchantable timber values. There are two methods for estimating the values of premerchantable and reprod forests. One method is to
“grow out” the young timber to the rotation age and then discounting the values to the present. In that case, the appraiser needs to know the following variables: future timber price increase, logging costs, inflation rates, and needs to estimate the discount rate. Another method is to analyse the market data and use it to find out the values for premerchantable and reproducible timber. For example, appraisers could find the value from premerchantable and reproducible timberland transaction data. The adjustment process is as follows: the appraiser calculates the total value of the timber by multiplying the total volume per hectare with certain timber age class values and then multiplies it with the share amount of this age class. Then the appraiser sums all the values together and finds the adjustment amounts for each comparable relative to the subject timberland property. (Healy Jr. & Bergquist, 1994)

**Site features adjustment**

While all the previous adjustments were quantifiable, the site features adjustment is more subjective and is based on the appraiser’s opinion. Here the appraiser has to evaluate the following factors: internal roads, external roads, type of terrain, natural and man-made hazards, site uniformity, distance from mills and other factors. Most of these are not quantifiable and therefore the appraiser uses their own opinion about the comparability and adjusts the sales comparable to make it similar to the subject property. (Healy Jr. & Bergquist, 1994)

**Total size of the tract adjustment**

The size of the site is another factor to adjust. The reasoning behind it is that many investors are not financially capable of buying very large tracts. Therefore the bidding is smaller and price per hectare of very big timberland properties is somewhat discounted. The amount of discount depends on the market. If it is a sellers’ market, there might be very small or practically no discount at all. On a buyers’ market the discount of per hectare price of very large timberland properties in comparison to smaller properties can be quite enormous. The adjustment for the size of the tract of a sale comparable is also very hard to quantify. Therefore it is subjective and strictly the opinion of the appraiser. (Healy Jr. & Bergquist, 1994)

**4.2.4 The cost approach**

(Pagourtzi, Assimakopoulos, Hatzichristos, & French, 2003) argues that generally, in real estate valuation practice, the cost approach is used when the subject property is sort of special
- rarely sold and does not produce any rent. That is, it is not possible to value the property with neither the comparable sale method, nor with the income capitalization approach. (Appraisal Institute, 2008) describes the cost approach as a valuation technique in which the subject property value opinion is established through comparison with the cost to construct the same property.

(Appraisal Institute, 2008) defines the replacement cost as “the estimated cost to construct, at current prices as of the effective appraisal date, a substitute for the building being appraised using modern materials and current standards, design and layout.”

(Kobriger, Boone, Weiss, & Chambers, 2011) explains that the value of timberland, in the case of young stand, consists of the market value of the land without trees and the accumulated costs related to the preparations of land and planting of trees. Bare land value will be estimated with the comparable sales approach or with the land expectation value method. The stand does not have value as pulpwood or saw-timber when the tree stand is very young. Nevertheless, according to (Association of Consulting Foresters of Australia, 2009), the value of the timber is considered to be the costs on the preparations of the land and the cost of planting on the basis of replacement costs. (Viitanen, Hannelius, & Airaksinen, 2006) states that in forestry the cost approach is only used to value timberland with a young tree stand. According to (Kobriger, Boone, Weiss, & Chambers, 2011), numerous reports show that the cost approach is not very popular among appraisers.

(Kobriger, Boone, Weiss, & Chambers, 2011) argument that the cost approach is occasionally used by appraisers to advise investors and to insure that they make the correct investment decisions. (Kobriger, Boone, Weiss, & Chambers, 2011) also discusses that insurance companies are valuing properties on the basis of the replacement cost and that the cost approach is a way of finding the replacement cost for timberland.

4.3 Uncertainty within valuations

(Mallinson & French, 2000) and (Adair & Hutchison, 2005) conclude that all real estate appraisals are somewhat uncertain and it is impossible to eliminate uncertainty from appraisals. There are several sources for uncertainty, for example, lack of comparable sales, lack of information regarding the market, etc. The appraiser estimated value figure is not an objective fact, but rather an appraiser’s opinion. Regardless of that, clients and third parties seem to use valuation estimates as if they are facts.
4.3.1 Error and Bias

According to (Bowles, McAllister, & Tarbert, 2001), the term “error” in appraisal context does not represent systematic misjudgements or inaccuracies made by appraisers. In a valuation context the term “error” is used to assess the gap between the true value and the measurement. In (Bowles, McAllister, & Tarbert, 2001), authors divide “error” into two: inaccuracy and imprecision.

“...imprecision error ... is defined as the random difference between the population mean valuation (measurement) and other valuations of the same property. “

and

”Inaccuracy is defined as the fixed difference between the ex-ante valuation(s) and the underlying true market value of which actual price is taken as the best indicator. “

Therefore, appraisers’ reaching to a different value conclusion does not show inaccuracy, but rather imprecision. Nevertheless, the authors state that it would be irrational to think that appraisers are capable of predicting the transaction price perfectly precisely or accurately. Errors in valuation are random and tend to cancel out if they are observed at the portfolio or property index level. There is, however, a distinction between error and bias. (Bowles, McAllister, & Tarbert, 2001) defines bias as follows:

“Bias is defined as the systematic (as opposed to random) deviation between valuations and true values/prices. It is associated with a tendency towards over- or undervaluation. “

Bias is generally caused by some sort of valuation inertia. For example, in a fast growing market there is a potential of systematic undervaluation, or in a declining market there is a tendency of systematic overvaluation. As bias is systematic and appraisers all tend to do mistakes in the same direction, it does not even cancel out on a portfolio or index level.

(Bowles, McAllister, & Tarbert, 2001) states that it is not possible to get rid of the valuation error. The reason is lack of information and also that all appraisers do not process the information in the same way. They use different methodologies which produce different value estimations. Different value opinions are also caused by the thinness and heterogeneity of the market.
4.3.2 True market value, transaction price and assessed value

(Bowles, McAllister, & Tarbert, 2001) explains that investment market value, according to financial theory, is merely the present value of future cash flows. Of course, since the investment market is dynamic and carries a high degree of unpredictability, there is practically always a difference between the assessed value and the true realisation value.

(Geltner, Graff, & Young, Random Disaggregate Appraisal Error in Commercial Property: Evidence from the Russell-NCREIF Database, 1994) defines the true market value as the mean of distribution of historical transaction prices, while the real transaction price is simply a random sample from the distribution. Consequently, the transaction price of a property is viewed as a sum of the true market value and the random error shown on Equation 14.

\[ \text{Price}_t = \text{TrueMarketValue}_t \pm \text{Error}_t(e_t). \]

*Equation 14. Transaction price, (Geltner, Graff, & Young, 1994)*

Furthermore, the appraisal is considered as a summation of the random error and the transaction price shown on Equation 15.

\[ \text{Valuation}_t = \text{Price}_t \pm \text{Error}_t(u_t). \]

*Equation 15. Valuation (Geltner, Graff, & Young, 1994)*

Consequently, the true market value can be considered as a sum of the valuation and two different errors shown on Equation 16.

\[ \text{TrueMarketValue}_t = \text{Valuation}_t \pm (e_t) \pm (u_t). \]

*Equation 16. True market value (Geltner, Graff, & Young, 1994)*

Apparently there are two fundamental error causes: random pricing error and random valuation error.

4.3.3 Uncertainty in valuations

According to (Mallinson & French, 2000), uncertainty can be divided into normal and abnormal uncertainty. Authors explain that abnormal uncertainty comes from a certain market
condition or from some condition related to the property that makes appraisers unable to estimate the value with normal confidence and accuracy. Normal uncertainty is described as an uncertainty regarding the value estimation that arises to appraisers mind and causes the appraiser difficulties in evaluating the market or to evaluate how the market prices some of the property features.

According to (Adair & Hutchison, 2005) and (Lorenz, Trück, & Lützkendorf, 2006), the main sources of normal uncertainty are lack of knowledge and absence of information, regarding the inputs that are used in an appraisal process. In their paper, they point out a spectrum of uncertainty developed by (Hargitay & Yu, 1993). One end of the spectrum represents certainty and the other end total uncertainty, partial uncertainty and risk are in between these absolute values. The difference between risk and uncertainty is that in the case of risk probabilities, outcomes are known, while in the case of uncertainty, outcomes might be known, but not their probabilities. In order to make correct investment decisions, the valuation end user must distinguish between these two.

4.3.4 Reporting uncertainty

(Lorenz, Trück, & Lützkendorf, 2006) argues that risk and uncertainty are both integral parts of the appraisal process. Yet, the judgments on whether or how to present risk and uncertainty in valuations are left totally to the appraiser to decide. (Adair & Hutchison, 2005) mention that the appraiser’s profession is often criticised because of the discrepancies and poor reporting of risk and uncertainty in valuations. The authors think that the problem lies in the transparency and traceability of the valuation estimates, not in the usage of different valuation approaches.

In (Mallinson & French, 2000), authors explain that the property valuation process is a lot about managing probabilities and the appraiser’s job is to find the most probable value estimate. If the value estimate is presented as a single figure with little or no explanation, it causes misunderstanding and could be treated incorrectly by clients and third parties. Uncertainties concerning the value that are usually not marked in the valuation report would be very precious to the one acting upon a valuation. (Adair & Hutchison, 2005) points out that reporting a single figure value estimate also gives the end user a vague idea that everything below that figure is necessarily a bad transaction for the owner.
(Mallinson & French, 2000) recommends to present uncertainty by giving out six items instead of just one value estimate. These are: single value estimate, the range of the most likely observation, the probability of the most likely observation, the range of higher probability, the range of 100 per cent probability and the skewness of probabilities.

(Adair & Hutchison, 2005) argues that one reason why appraisers do not want to use very sophisticated methods for reporting risk is because they do not want to confuse the clients. (Adair & Hutchison, 2005) points out three possibilities of dealing with uncertainty: ignoring it, expressing it verbally or expressing it numerically. (French & Gabrielli, 2004) advises to express uncertainty numerically by using the Monte Carlo simulation.
5. Current timberland valuation practice: Results from interviews

The aim of this part of the thesis is to summarize the interviews conducted among companies that appraise timberland. For the sake of simplicity, summaries about Estonian and Sweden valuation practices are separated. Firstly, this allows showing how timberland valuation varies within a particular country and also how the theory matches the practices. Secondly, this allows pointing out the main differences between timberland valuation practices in Estonia and Sweden.

5.1 Timberland valuation practice in Estonia

Large real estate valuation companies in Estonia, such as Arco Vara AS and Uus Maa Kinnisvarabüroo AS, have licensed land appraisers. Nevertheless, these companies do not appraise timberland by themselves, but buy the timberland valuation service from companies that deal with forest management. As Virgo Laansoo from Arco Vara AS pointed out, the amount of valuations ordered is trivial and therefore the valuation service is mainly outsourced.

In Estonia, six representatives from different forest companies were interviewed: Peep Põntson (manager of Metsaekspert OÜ), Meelis Kasemaa (appraiser at Metsanõustamise OÜ), Ülo Viilup (forest management at Metsabüroo OÜ), Mart Erik (board member at Kinnistu OÜ), Tanel Tuuleveski (director at Holmen Mets AS), and Juhan Kütt (manager of Metsamaahalduse AS).

The summary of the interviews is presented below each question. The full list of questions or key points can be found in Appendix 1.

General questions

*How many years of experience do you have in timberland valuations?*

On average, six respondents had experience in forest management and timberland appraisal for approximately 20 years. All the respondents had at least 10 years of experience, and one of the respondents had almost 30 years of experience.
years of experience in timberland valuation. This shows that the following answers should be of high relevance. Statistics about respondents’ experience are shown on Graph 6.

**How many timberland valuations does the company you work for conduct every year?**

Four out of six companies could be characterized as forest managing companies that are providing different forestry services like forest inventory, forest management plans, valuation, consultation, mapping and surveying. Moreover, these four companies have workers that have a forest management certificate. The two other companies mainly deal with timber trading and timberland broking respectively and they do not provide valuation services individually, but rather appraise timberland for their own use. For example, the representative from this timberland broker company referred to the fact that in the year 2011, approximately 1000 properties were sold (including farmland properties). Graph 7 describes the number of valuations that were made by the other five companies.

**What are the purposes of timberland appraisal?**

Timberland appraisals are usually made in order to give the client an idea about the value of a particular property. According to the respondents’ answers valuation reports are ordered by potential buyers and sellers who need estimation about the value. According to the words of one respondent, he had valued timberland for collateral of bank loan twice in his life. However, in

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10 List of people that have forest management certification in Estonia provided by Estonian Environment Information Centre: [http://www.keskkonnainfo.ee/main/index.php/et](http://www.keskkonnainfo.ee/main/index.php/et)
Estonia timberland is not usually taken as collateral for bank loans, because standing timber was, according to the respondent, considered being too risky from the perspective of the banks.

Only one respondent pointed out that valuations are done for court cases, when some conflicts have been involved. Finally, these two companies that had a different main line of business than forest management services do not usually issue valuation reports, but valuation for them is everyday practice. For instance, according to the words of the representative from the timberland broker company, all properties are valued they are sold to the next client.

At least half of the respondents put emphasis on the fact that real estate appraisers from different big companies do not have enough knowledge about the forest in order to be able to succeed in valuing timberland. In their opinion, it is important to know more about the local area and about the forest itself, than is described in the forest management plan. They also found it important that timberland appraisers should go to the forest by themselves in order to gain deeper understanding about the value of particular property.

**Valuation method**

*What kind of different valuation approaches have you used for valuating timberland?*

All the respondents claimed to use the income method only or a special case of the income approach. A third of the respondents use a classical income approach, in the case of which cash flows are discounted into present, whereas two thirds of respondents use a special case of the income approach.

Half of the respondents that are using a special case of income method claimed that for standing timber that cannot be harvested immediately they give lower value per cubic meter. This value ranges around 10 Euros per cubic meter that is substantially below the value of merchantable timber, which is around 35 Euros on average. One respondent explained that the value given to premerchantable timber depends highly on the species that are dominant (i.e. conifers are more expensive), as well as on quality and age of the stand. In general, the cubic meter value that is imputed to premerchantable timber has not much theoretical reasoning behind and it is also highly dependent on the appraiser’s opinion. Finally, the last third of the six respondents do not discount or adjust the incomes and costs at all and take these the cash
flows of a certain period as if these would occur at the date of valuation. *Graph 9* gives an overview of how the appraisers treat the future income.

Including the value for premerchantable timber in the income approach also differed among the respondents. As it could be seen from *Graph 10*, two respondents did not add any value from standing timber that could not have been harvested immediately.

In a nutshell, the value of the land is added to the calculation in some cases, but it has a somewhat formal meaning. As one respondent added, the land value is sometimes added for rounding purpose, because the land has a very marginal value in comparison to the value of timber. Another respondent revealed that the land value is sometimes considered as a bonus when investment decisions are made. Meaning that, the value of the land is added to the value that could be obtained from selling timber. This respondent also added that ten years ago companies paid for timberland in a way that after selling timber they were in profit and also got the land. However, things have changed nowadays, and on average, after selling timber from clear cutting, they end up with no or small profit plus the land that they get. More about the values for bare land will be discussed in later in this thesis.

**Income method**

*What is the number of periods (years) in the income model that is used for valuing timberland or do you use a perpetuity model?*

All the respondents claimed to use a ten year period in the timberland valuation income model. The respondents reasoned that this is because the forest management plan is made for
a 10 year period and the forest management plan gives information about timber inventory, ages of stands, species mix, size of property, cutting ages, suggested thinning timings, information about soil and suggested forest management activities. When the valuation is made on the basis of the forest management plan then it is possible to comprehend about quantities of timber that could be harvested immediately and in the future.

**What kind of costs and revenues do you take into account in the income model?**

All the respondents said that the income comes from selling timber as pulpwood or logs in different assortments, according to species and diameter. Moreover, one respondent said that he also takes income from chip wood into account if it is economically profitable to produce it.

As for the costs, the main expenses come from harvesting (i.e. machinery and labour), forwarding and transportation. According to the respondents, these costs are always included in the calculation of the market value of timberland. Replanting costs are also included if replanting is required after clear cutting by the forest management plan. Moreover, some of the respondents said that if some unusual or site-specific costs are foreseen, these will also be included in the costs.

The main sources of income and costs brought out by the respondents are concluded as follows:

- **Income**
  - Clear cutting
  - Thinning
  - Chip wood (mentioned once)

- **Costs**
  - Harvesting
  - Forwarding
  - Transportation
  - Replanting
What pre-tax and post-tax discount rates do you use? Include numbers!

Four respondents out of six do not discount future cash flows, one respondent discounts at a 3\% rate and another uses a rate of 4.5\%. Both of them used pre-tax discount rates. The respondents said that in Estonia, appraisers generally use pre-tax discount rates because the corporate income tax rate is 0\% (only dividends are taxed). Used discount rates are summarized on Graph 11.

**What is the basis of the discount rate?**

As was mentioned above, two out of six respondents discounted future cash flows. One of the respondents, who used a 3\% discount rate, was not able to explain any theory behind the discount rate. Another respondent, who used a rate between 4\% and 5\%, reasoned that the basis for this rate is their own rule that the incomes from the second clearing phase (after year 5) will be given 80\% of the value that could be obtained when selling this timber immediately (year 1). The respondent further stated that, according to the Estonian Forest Law, it is stipulated how much timber could be harvested in the first phase. The area that was cleared in the first phase needs to be regenerated by nature or additional replanting should be done in order to conduct the second phase of cutting after year 5 (usually it is allowed to harvest after 5 years from the first cutting, but further instructions could be found in the Estonian Forest Law).

**How do you determine and where do you get information about timber prices and costs for harvesting, transportation, replanting, etc.?**

Five out of six respondents use current timber prices to determine incomes in their valuations. One of the respondents uses price statistics from the website of the State Forest Company (RMK)\(^{11}\) and the Private Forest Centre\(^{12}\). Compared to current timber prices, these price statistics are lagging behind a couple of months depending on when the information on the websites is renewed that is described also in Graph 12.

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\(^{11}\) www.rmk.ee

\(^{12}\) www.eramets.ee
Current price information comes from local saw mills or timber buying companies in particular regions. It depends on the partner companies that timberland appraisers are cooperating with. Timber prices are changing every day and price lists are adjusted constantly. Usually these companies interact frequently and change information about timber prices. Most of the respondents calculate the value for different assortments of timber which means they have unit prices for a range of assortments. Usually there are 10-20 assortments in the list that contain prices for logs, pulpwood and firewood depending on the species, dimensions and quality. The respondents who use this method think that it is more profitable to sell timber when it is sorted, but one respondent pointed out that selling standing timber is more profitable. The latter was explained by the reasoning that big companies offer better prices for the whole timber, because one saw mill does not buy all assortments and it is not beneficial to transport small quantities of timber of specific assortments to the mill that is located in another region.

All the respondents emphasized that timber prices are highly volatile and fluctuations influence timberland values. All the respondents agreed completely that timberland value reacts immediately to the changes in timber prices. Moreover, one respondent mentioned that there is no big difference which discount rate is used, because timber prices are fluctuating so much and this leads to inaccurate estimates about the value. In addition to that, a number of respondents pointed out that it is extremely difficult to make any predictions about future timber prices. One respondent stated that timber price changes do not follow any logical patterns.

One respondent explains that pulpwood prices are determined by the big Scandinavian forest companies that are importing timber from Estonia and pulpwood prices change when timber terminals notify that some particular assortments are not bought.
The respondents agreed that costs related to harvesting, forwarding, transportation and replanting are certainly not as volatile as timber prices. Over time they have found certain partners and daily cooperation gives information about costs for different services that these companies are offering. These costs could be a bit different during the high season and also during the winter when all the machinery is usually fully exploited.

*Do you use different discount rates for valuing stands with different ages?*

Respondents that are discounting future cash flows applied the same discount rate for valuing stands with different age classes of timber.

**Comparable sales method**

None of the six respondents who were interviewed use the comparable sales method for valuing timberland. One respondent pointed out that all forest properties have different characteristics and that makes it difficult to find similar comparable transactions and therefore it is complicated to use this method. He also mentioned that this method is clearly not suitable for valuing small units, but for valuing large forest tracts with more than 10,000 hectares. He explained that the differences average out when valuing large properties, which does not happen in the case of small properties and therefore the difference between an estimate and a market value could be large.

Another respondent claimed to use the comparable sales method to value farmlands. He added that valuing farmland is much more transparent in comparison to timberland and takes less effort to get a relatively good estimate about the value.

**Cost method**

*Have you used the cost approach to value timberland?*

None of the respondents have ever used the cost approach to value timberland.
Valuation reports

Is it your opinion that the market value in a valuation should include an uncertainty interval?

All respondents shared the opinion that uncertainty intervals are not necessary for valuations. For example, one of the respondents mentioned that the valuation is already an approximation and giving some kind of intervals does not increase the quality of the valuation. Another respondent added that they present the final value as the lowest price that particular property could be sold for and below that price there is no reason to sell. In general, the respondents had the opinion that valuations are made for giving some idea about the market value of a particular property, but not about the price that this property will be sold for.

What kind of sensitivity analysis (which parameters are tested) do you perform in your valuation process?

No kind of sensitivity analysis was done among the respondents. The explanations were the same as discussed underneath the previous question, mainly because valuations are already estimates of the value and there is no need to consider a sensitivity analysis.

Other

What value does the land have when a clear cut has been made (value for bare land)?

On the Graph 13, the prices for bare land (timberland after a clear cut) are described according to the words of these six respondents who were interviewed. One respondent stated that there are no investors that are willing to pay for a land without trees. Another respondent believed that bare land could not be sold separately; instead, it could be combined to bigger portfolios that contain different properties. According to the Estonian tax law, different types of timberland have particular assessed value based on the production capacity of the land. For example, one of the respondents uses these prices in his reports for the basis for timberland.
5.2 Timberland valuation practice in Sweden

According to words of one timberland appraiser that has Aspect certification, he explained that people without having this license are allowed to value timberland, because there is no particular law for that. He believes that in the future, valuing timberland will be regulated by the law. Even nowadays, banks, government institutions and others require Aspect certification, which guarantees valuations with reliability and quality. He also added that there are numerous of “less serious professionals” that are offering same services as licenced timberland appraisers and customers do not have enough knowledge to find appropriate expert. Altogether, there are 26 licenced timberland appraisers in Sweden.13

Around 30 timberland appraisers all over Sweden were asked for an interview, approximately 10 replied and it was possible to conduct an interview with 6 of them. These were Per-Anders Arvidsson from Parason AB, Mikael Gröndahl from Värderingsbyrå, Anders Nyberg from Forum Fastighetsekonomi AB, Magnus Gyllemark from Värderingsbyrå, Anders Brun from FastighetskonsultAnders Brun AB and Björn Nilsson from Landeum KB. All the appraisers that were interviewed have Aspect certification for valuing agricultural land including timberland.

The summary of the interviews is presented underneath together with the questions asked. Some of the questions are not brought out merely because appraisers had not used subject technique or approach. The full list of questions or key points can be found in Appendix 1.

General questions

How many years of experience do you have in timberland valuations?

The average experience among the 6 respondents in timberland valuation was approximately 16 years. All the respondents had at least 7 years of experience, while three of the respondents had almost 20 years of experience in timberland valuation.

13 List of appraisers that have Aspect licence could be seen on webpage: http://aspect.se/ASPECT-hitta-auktoriserad-varderare.html
How many timberland valuations does the company you work for conduct every year?

As *Graph 15* describes, number of timberland valuations conducted per year is between 50 and 200. These numbers are representing the total amount of valuation made by particular company in specific region.

What are the purposes of timberland appraisal?

As found out during the interviews, the main clients who order valuations are public authorities or municipalities. In such cases, assessment about the value is needed in order to compensate to the owner for building infrastructures or nature reserves. In other cases, valuations are ordered by private persons who are interested in dividing properties in the circle of family members, or there is some conflicts that require estimation the value of timberland.

Valuation method

What kind of different valuation approaches have you used for valuating timberland?

All six respondents use the comparable sales method as well as the income capitalization approach for valuing timberland. The income approach is based on computer aided software called BM-win, which has been developed over 20 years by the National Land Survey of Sweden (Lantmäteriet). The letter combination BM is short for “Bestånds Metoden” in Swedish and means Stand method in English. Just as the income approach, the Stand method is also based on cash flow analysis that is used for calculating the value from perpetual periods of incomes and costs. With this method, timberland value is determined on the basis of several field conditions that are determined by the appraiser. Operations like thinnings, final cuttings and other silvicultural activities are projected into the future on the basis of the information in forest management plans. Later, future incomes and costs that appear at different points of time are discounted to the present with the discount rates by the
appraiser\textsuperscript{14}. Note that, in following text, using term Stand method refers to the income method applied to computer aided program BM-win.

\textit{Which of the two approaches do you think is the main valuation approach when valuing timberland, income or the comparable sales approach? Why?}

The interviews showed that half of the respondents consider the comparable sales method as the main method for timberland valuation. Two respondents told that both approaches are equally common in timberland valuations and one of respondents stated that final decisions about the value are made mostly using results from the income capitalization approach. These figures are showed on Graph 16.

One respondent explained that the comparable sales approach is almost always the main method and the income approach is useful for describing the property. Because in the case of which valuations are made for conflict situations, which could end up in a court, value estimates must be established by using the comparable sales approach. Another respondent specified that the latter is regulated by Swedish law. He added that reports should always be elaborated in a way that quality reaches the level that is suitable for court cases.

Nonetheless, one appraiser stated that the Stand method gives a more accurate value estimate in most cases, but sometimes this value is far from the “real” value. In these cases, the comparable sales method helps to reach to more credible value estimations. Another respondent considered the value estimations from the Stand method to be more varying, but both methods are equally important in order to assess the value of a timberland properly.

\textit{Valuing different types of timberland: are different methods preferred in valuing different types of timberland? If yes, then how?}

\textsuperscript{14} Additional information about BM-win valuation program is provided in Appendix.
The interviews revealed that the choice of the timberland valuation method does not depend on the type of timberland under valuation. The mindset was that it depends rather on the availability and the quality of the data for a particular property. One respondent suggested that if there are not enough comparable sales available, then the Stand method should be used.

It was said, that when timber volume per hectare is low, then the Stand method underestimates the value, and when the volume per hectare is high, it overestimates the value. Therefore, it is sometimes important to use the comparable sales method which helps to justify the results. A similar answer was given by another respondent who explained that by using the Stand method, properties that have high production capacity (growth rate) will get much higher values, than are paid for these plots on the market, and the other way around. He also called attention to one controversial circumstance on the market: if everything else is equal, the buyers are generally paying the same price for properties with different producing capacities.

Do you use more than one valuation method to reach to the market value conclusion or do you control the main method with some other method?

All of the respondents claimed to use the comparable sales method and the stand method together. Valuation reports always include both of them, but the final decision about the value could be made preferring one method to the other. Obviously, it depends on numerous factors and some of these were described above.

Income method

What is the number of periods (years) in the income model that is used for valuing timberland or do you use a perpetuity model?

All the respondents claimed that the Stand method is built on the perpetuity or land expectation value model.

What kind of costs and revenues do you take into account in the income approach?

All the respondents referred to the BM-win computer program when they were asked about incomes and costs that are included in the calculation model. For example, one of the respondents said that everything that is needed could be added to this model. Regarding the
income, timber volumes are fed into the program along with a price list for different assortments, which allows calculating incomes from thinnings and final cuttings that are going to take place in the future during different time periods. The excess value that comes from hunting activities is not included in the model, but the respondents said that it is added to the final value. One respondent highlighted that the value coming from hunting activities could be approximately 10% of the total value and is therefore important to include.

Regarding the costs, the BM-win model has several ways of estimating all the costs related to harvesting, forwarding, transportation, scarification, replanting, regeneration, management or other activities. The task of the appraisers is to select the appropriate costs and assign the right unit prices, which depend on the region.

**What pre-tax and post-tax discount rates do you use?**

It was found that all the respondents use pre-tax discount rates. Timberland appraisers from different parts of Sweden were questioned about the discount rate they are using. The answers varied from 2% to 5% which can be seen from the *Graph 17*. All the respondents said that the discount rates change depending on the region. Another factor, which has an impact on the discount rate and was considered to be important, was the age of a stand. In some cases two discount rates are used, which will be explained later in the thesis.

**What is the basis of the discount rate?**

All the respondents calculate the discount rates based on market information about recent transactions and current prices. One respondent explained this mechanism by composing sample properties for each region (approximately 30-40 different regions in Sweden), and by using current timber prices, they run the calculations for deriving discount rates. Subsequently, these rates are used for estimating the value of a particular property using current timber prices and the corresponding costs for a certain region. These results are again compared to market prices and then the discount rates used will be adjusted if necessary.
In addition, one respondent mentioned that National Land Survey of Sweden provides recommendations about discount rates that could be used in their calculations on their web site\(^{15}\). These discount rates are also adjusted up- or downwards based on the market information. Another respondent also considers the cost of capital and the expectations about future prices when estimating discount rates.

**How do you determine and where do you get information about timber prices and costs for harvesting, transportation, replanting, etc.?**

The interviews revealed that timber price information is generally obtained from the direct communication with partners, who are timber buyers in smaller regions, or with big companies that hold bigger market shares. One respondent pointed out that partners constantly negotiate and interchange information about the prices by using channels like the Internet, e-mails and phoning. All the respondents use the current price information in their calculations, which they have gathered into different price lists that represent a particular region. These prices on the lists are taken as minimums that could be obtained; however, as one respondent explained, selling the right for harvesting to some company could yield a higher value. He added that there is always a need for comparing different alternatives in order to maximize the value.

Another respondent said that in order to capture the possible timber price changes in the future, National Land Survey of Sweden is issuing recommendations about possible price movements, which gives at least some idea about price dynamics. National Land Survey of Sweden also gives recommendations about costs related to harvesting, thinning, forwarding, transportation, cultivating, replanting and regeneration for Northern, Central and Southern Sweden.

**Do you use different discount rates for valuing stands with different ages?**

BM-win enables to use two different interest rates, in which the higher one is used for discounting older stands and the lower is used for younger stands. All six respondents mentioned that they use the higher interest rate for older or mature stands, because older trees

are considered to be more risky due to storm damages, bugs and other loss. One of the respondents pointed out, that using lower discount rates for young stands results in higher value, which could be considered as compensation for potential young stands have, because the immediate harvest value for young stands is very low.

For example one respondent from Southern Sweden pointed out that the discount rate for timberland without trees or with young trees is between 2.5-2.8%, while it is 3.0-3.5% for timberland with a mature stand of trees.

**Comparable sales method**

**How many comparable sales do you consider before making any decisions?**

As can be seen from the *Graph 18*, respondents need approximately 30 comparable sales in order to get supporting background information about recent sales. One respondent referred to the fact that 30 transactions from a 1 year period could be considered as good enough for making further decisions. However, another respondent pointed out that he prefers to look at larger regions with 30 to 80 comparable sales over 2-3 years and sometimes more than a 100.

At least half of the respondents referred to the issue that the number of sales used depend on the area under consideration. Another respondent mentioned that he uses more comparable sales for making volume adjustments in order to get a more trustful basis. In the end, different approaches were preferred by appraisers. To illustrate, one respondent stated that valuation is an art and sometimes there is a need for using imagination and experience if not enough samples are available.

**Where do you get information about comparable sales?**

All six respondents collect information about transactions from real estate brokers and agencies. Based on this information, the appraisers create their own databases, which have a fundamental role in valuations. In order to have decent databases, a lot of effort is put to
information collection, sorting out trustful material as well as to communicating with seller side. One appraiser pointed out that comparable sale data is precious and therefore a well-guarded company secret. He also mentioned that in some cases this data is sold or exchanged with other appraisers.

**On which basis do you make time adjustments?**

Time adjustments were considered easy to conduct and are done frequently by all six respondents. One respondent explained that he looks for representative sales for a specific region from their database and then tries to capture the changes in price per hectare over time. Furthermore, another respondent explained that another way of conducting the time adjustments is to look at the price movements for all transactions in a particular region over some period of time. The interviews revealed that half of the respondents claimed to look at the average price per hectare change in the region, whereas another half tries to capture price changes with the help of representative properties. For example, one respondent presented Graph 19 that showed price changes from 1998 to 2010 in Värmland in Sweden, and mentioned that this graph could be used for making time adjustments.

*Graph 19. Price of timberland over time – Sweden. (Source: provided by Björn Nilsson from Landeum KB)*
How do you make volume adjustments?

Timber volume adjustments were considered important, since an amount of timber has direct effect on the value of timberland. According to the interviews, two thirds of the respondents use the simple regression analysis, in which timber volume (cubic meters per hectare) and timber price (per hectare) are plotted on Graph 21 and the best fitting linear function is found. The function is then used to adjust the price of a comparable sale for it to be comparable with a subject property. The other two respondents claimed to choose representative properties that have similar timber volumes per hectare from the database. One appraiser explained that comparable sales with timber volumes that are higher or lower in comparison to the subject property are excluded.

How do you make species mix adjustments?

Four respondents make adjustments for species if needed. For example, one respondent suggested that comparable sales are chosen by leaving out properties with different dominant species compared to the subject property. Moreover, another respondent pointed out that different species of timber differ in value which influences timberland value. One of the
respondents, who agreed on making adjustments for species, added that these are done sometimes, but not so often.

Another respondent, who does not make adjustments for species, argued that there are mainly conifers in his regions which have no difference in price and therefore he does not need to do species mix adjustments. Finally, the last respondent did not mention anything about the importance of making adjustments for species mix. Distribution between timberland appraisers that conduct adjustments for species mix and those do not, are presented on Graph 22.

**How do you adjust for timber quality?**

Interviews revealed that adjustments for timber quality were not so common or not used at all. One appraiser pointed out that timber quality adjustments are difficult to conduct and he was pessimistic that it could lead to a better estimate of market value. Another respondent added that in Northern Sweden, timber is merely divided into logs and pulpwood without assigning any assortments or level of quality.

**How do you adjust for stand age?**

Three out of six respondents clearly expressed that everything else equal to a timberland is worth more if the ratio between mature and immature timber is higher. Two respondents did not mention that stand age is considered when making adjustments. Finally, one respondent shared the opinion that adjustments for stand age are not important. Respondents’ preferences about doing adjustments for stand age are shown on Graph 23.
What kind of site features do you take into account in site features adjustments?

Site features, that were considered important, are the production quality of the soil, the accessibility of roads and the shape of plot. One appraiser mentioned that, if everything else is equal, plots which have a square shape are worth more. The location also plays an important role, timberland has higher value when it is situated close to a lake or is near residential areas. However, one respondent added that, the latter is measured subjectively and is therefore hard to consider in the valuation report.

What kind of factors do you consider in the case of transaction quality adjustments?

All respondents agreed that comparable sales prices which are not arm’s length transactions or do not represent the market value are excluded. One appraiser explained that information about the background of transactions could be unclear which requires making judgments about particular trades concerning their transparency, following open market principles, and deals between relatives.

How do you adjust for the total size of the property?

Four respondents shared an opinion that smaller properties are slightly overvalued and the other two respondents did not mention anything about adjustments for the total size of the property. One respondent supported his opinion by saying that larger properties were sold with little discount about 5 years ago, but not anymore. One of the respondents introduced Graph 24 which proves the idea that prices for properties with lower volumes are higher. He explained that cutting timber is not the main reason for buying timberland in Sweden, people are interested in hunting and they need to buy timberland in order to have the right to hunt in bigger areas. In these cases, people are willing to pay more for the plots that have a relatively little amount of timber.
Cost method

Have you used the cost approach to value timberland?

None of the respondents have used the cost approach according to the interviews.

Valuation reports

Is it your opinion that the market value in a valuation should always include an uncertainty interval?

None of the six respondents used uncertainty intervals in their valuation reports. Different reasons were presented, for example, banks or other clients do not like these value intervals. One of the respondents added that the final result is rounded anyway and therefore it does not make sense to give out some intervals. One respondent stated that all clients prefer to have the final value as a single number.

What kind of sensitivity analysis (which parameters are tested) do you perform in your valuation process?

Sensitivity analysis was not performed by these six respondents who were interviewed.
Other

What value does the land have when a clear cut has been made (value for bare land)?

From Graph 25, prices for land after clear cutting are presented. According to the respondents land prices are higher in Southern of Sweden where the land is more fertile. In contrast, land prices in Northern of Sweden are lower explained by lower productivity of timberland.

![Price of bare land per hectare in Sweden (Eur)](image)
6. Analysis

How timberland market value is appraised in Estonia and Sweden was the main question in this thesis. This chapter of the thesis will analyse the results from the empirical study, discussing the sub-questions as well as the main questions stated in the introduction. The analysis also tries to find parallels between the scientific theory and empirical findings, as well as differences between the timberland valuation practice in Estonia and Sweden.

6.1 Purpose of the valuation

(Pagourtzi, Assimakopoulos, Hatzichristos, & French, 2003) discusses that the most widespread purpose for an appraisal is to determine the market value of the property for a potential purchase or sale. Nevertheless, there are many other situations that may call for an appraisal, for example, exchange, taxation, gifting, partial taking, etc.

The empirical study of this thesis shows that timberland valuation is mainly done for acquisition purposes and compensation proposes, for instance when public authorities need to compensate the owner of the land for building an infrastructure or natural reserves on his or her land. The respondents also mentioned that timberland is appraised for purposes such as dividing a property within a family circle which is common in Sweden. Timberland appraisal for collateral purposes is considered rare in Estonia, because banks do not accept timberland as collateral due to high risk.

6.2 Choice of the valuation method

The theoretical Section 4.2 of this thesis includes an overview of different timberland valuation methods and justification about when these methods should be used.

6.2.1 Valuation methods used for timberland valuation

The scientific literature uniformly agrees that the three most prominent timberland valuation approaches are the income approach, the sales comparison approach and the cost approach (Mellette, 2008; Kobrigrer, Boone, Weiss, & Chambers, 2011; Association of Consulting Foresters of Australia, 2009). It can be seen from the empirical work that not all these methods are used in practice. All appraisers who were interviewed used the income approach or a special case of it, the comparable sales approach, however, was only used by six respondents and none of the respondents had ever used the cost approach to value timberland.
The fact that cost approach is not popular among timberland appraisers was also brought out in (Kobriger, Boone, Weiss, & Chambers, 2011).

Notably, there are clear distinction concerning the valuation methods used in Estonia and Sweden. In Estonia none of the appraisers use the comparable sales method in practice. Moreover, some of them pointed out that this method is not appropriate for timberland valuation. In the contrary, the comparison approach was considered as the main method for valuing timberland in Sweden which is described more thoroughly in Section 5.2.

One respondent from Estonia explained that the comparable sales method could be used for valuing only large forest tracts, because the value becomes very sensitive to the adjustments when dealing with small units. The latter was also brought out by (Healy Jr. & Bergquist, 1994) where they point out three instances when the comparable sales approach could be helpful in valuing timberland: when the comparable sales were conducted recently, when big tree farms with more than 5000 acres and with multi-aged timber are valued and in case the timber is very young.

6.2.2 The main method for valuing timberland

(Kobriger, Boone, Weiss, & Chambers, 2011; Healy Jr. & Bergquist, 1994) state that the income approach is regarded as the primary timberland valuation approach. The results from the empirical study of this thesis do not support that. Half of the Swedish appraisers preferred using the comparable sales approach as the main approach. Yet, (Healy Jr. & Bergquist, 1994) states that the comparable sale approach is considered to be a secondary appraisal method after the land expectation value method in timberland appraisal. Only one of the respondents used the income approach as the main method and the other two appraisers pointed out that these two methods are used simultaneously. Contrary, in Estonia, the main timberland valuation method is the income approach, since this is the only method respondents claimed to use. (French N., 2005) argues, however, that the best or the right valuation method does not exist and that different circumstances demand different valuation approaches. The phenomenon that the comparable sales approach is not used in Estonia could be because most of the buyers are companies that are interested in the cash flows produced by the timberland rather than the market value of the timberland property itself.
6.2.3 Valuation approaches for valuing different types of timberland

According (Healy Jr. & Bergquist, 1994) the comparable sales approach could be helpful in valuing timberland when comparable sales are conducted recently, when big tree farms with multi-aged timber are valued, and in case the timber is very young. The cost approach, according to (Kobriger, Boone, Weiss, & Chambers, 2011), is suitable for valuing timberland with young stands.

The interviews in Sweden and Estonia revealed that the choice of the timberland valuation method does not depend on the type of the timberland property. In Estonia appraisers use income approach to value all types of timberland. The Swedish appraisers expressed that the choice of valuation approach depends rather on the availability and the quality of the data for a particular property. For example, if there are not enough comparable sales, then the income capitalization approach is favoured, but if the timber volume per hectare or the production capacity is abnormal, then the income approach could lead to wrong value estimates, in this case the comparable sales approach is useful for justification purposes and double checking the value estimate.

6.3 Implementation of the income approach

In the theoretical section of this work Section 4.2.2 discusses in detail how, according to scientific theory, the income approach should be applied for valuing timberland properties. (Straka & Bullard, 1996) states that the income approach used in forestry and timberland appraisal is called the land expectation value (LEV) method. The empirical part of the thesis shows that in Sweden the income capitalization approach is conducted through computer aided software called BM-win which is, to a great extent, based on LEV\textsuperscript{16}.

In the case of Estonia, two of the respondents use the classical income approach, where the time period in the model is 10 years, and four respondents use a special case of an income approach where the cash flows are not discounted or time adjusted at all. This special case of the income method is where the value of the premerchantable timber is considered as a fixed share from the mature timber, by using some constant or the value of premercantable timber is not considered at all. However, (Niskanen, et al., 2002) explains that if all the expenses and incomes were summed up without considering the time differences between occurrences the

\textsuperscript{16} Appendix 2 and Section 5.2 provide more explicit information about BM-win
profits in forestry would seem very high. Additionally, (Niskanen, et al., 2002) states that future cash flows must be converted or discounted to present before comparison with present values is possible.

6.3.1 The length of time period in the income approach
LEV, according to (Straka T. J., 2007; Straka & Bullard, 1996), is not an ordinary discounted cash flow analysis, because the timber in the LEV approach is growing to perpetuity, not just fixed number of years or one rotation. The interviews showed that Swedish interviewees are using a computer aided software BM-win to conduct the income capitalization approach and that software is based on LEV and therefore the time period is perpetuity. On the contrary, all the respondents from Estonia use a ten year time period in the income approach model merely because the forest management plan is made for 10 years and it is easy to grasp most of the the inputs from there. Nevertheless, the scientific literature about timberland valuation does not comprehend any information regarding a ten year income approach to value timberland. However, it is clear that if a ten year income approach is used to value timberland, appraisers must take into account the reversion value of the timberland, otherwise they would leave out the value of the stand that does not reach to maturity age within that ten year period and the value estimate would be biased.

6.3.2 Incomes and costs in the income approach
All the respondents in Estonia as well as in Sweden consider all the incomes and costs that appear during the modelling period. The main incomes include final fellings, thinnings and selling chip wood. The biggest difference between Estonia and Sweden includes adding the hunting value to the final value of timberland. In Sweden, it is around 10% of the total value of timberland, but in Estonia this is not considered as an additional factor to the value of timberland.

Regarding the costs, the expenses are relatively similar in the two countries. The costs depend on the subject property and silvicultural activities that are prescribed by the forest management plan. In Estonia, all timberland owners are obliged to pay taxes on their properties based upon the assessed value and at a tax rate that varies in different regions. However, none of the respondents include the costs for timberland tax in their valuation. On the contrary, (Straka & Bullard, 1996) suggests including timberland tax in the calculation.
6.3.3 Timber price and forest management cost information

Section 3.4 of this thesis discusses the sources of timber price information. According to (Mellette, 2008) there are three sources for timber price information: comparable timber sales, timber price reporting services and delivered log prices. Authors further point out that generally, the most reliable source is the comparable timber sales information. The empirical study of this thesis shows that all the respondents use the delivered log price information in their calculations, except for one appraiser who uses price statistics that are lagging a few months. Timber price information generally comes from local saw mills or timber buying companies in a particular region. (Mellette, 2008), however, warns that these prices fluctuate greatly with the lumber markets and mill inventories. All the respondents use the current price information (i.e. they do not use average timber prices over some period of time) in their calculations.

In addition, costs related to forest management activities are obtained by local regional partners or recommendations from National Land Survey of Sweden are also used by Swedish appraisers.

6.3.4 Discounting future cash flows

Altogether 8 respondents out of 12 discount future cash flows in the income approach with a discount rate, four respondents did not discount future cash flows. All the respondents who discount, use the pre-tax discount rate and the used discount rates were in between 2% and 5%.17

The empirical study shows that there are substantial differences in the basis for deriving discount rates that are used in Estonia and Sweden. According to the interviews in Sweden, the appraisers were using market information for deriving discount rates for different regions. These rates were adjusted according to the market information in order to provide more accurate results. (French & Gabrielli, 2004) also states that the appraiser usually obtains the view of the appropriate discount rate by analysing market information. Moreover, National Land Survey of Sweden also provides recommendations for discount rates that should be used in different regions of Sweden. On the contrary, one of the appraisers interviewed in Estonia could not even explain the theory behind the discount rate used and another respondent

17 Graph 11 and Graph 17 provide more information about the discount rates used in Estonia and Sweden.
considered incomes from the next felling as being equal to 80% of the immediate harvest value. This could be considered as a rough and subjective way of valuing without any supporting reference from the established theories.

The interviewees from Sweden pointed out that discount rates are dependent on the region as well as the age of a stand. (Price, 2011) points out the tendency that discount rates are lower for younger stands. Similarly, appraisers in Sweden use a higher interest rate for older or mature stands, because older trees are considered more risky due to storm damages, bugs and other loss. Also (Lorenz, Trück, & Lützkendorf, 2006) states that riskier investments should provide a higher return than safer investments. Respondents from Estonia were not able to discuss about the effect of stand age to discount rates due to lack of knowledge in this field.

6.4 Implementation of the comparable sales approach

The interviews showed that the comparable sales method was used by six respondents out of twelve. The empirical study found that none of the Estonian respondents use the comparable sales approach in practice. On the contrary, all six respondents from Sweden use the comparable sales approach routinely.

The Swedish respondents were concurred about the importance of having a decent base of comparable sale transaction data. (Pagourtzi, Assimakopoulos, Hatzichristos, & French, 2003) also emphasized the importance of the quality of recent real estate transaction information in the case of the comparable sales approach. Swedish timberland appraisers revealed that the possession of a thorough database of comparable sales is essential for valuing. Moreover, one appraiser stated that their database of comparable sales information is a highly guarded company secret. Generally, timberland appraisers acquire data from different brokers and transactions that are conducted by them.

Swedish timberland appraisers revealed that the number of comparable sales transactions used in the valuation depends on the region where the subject property is situated. In the shortage of price information, one appraiser mentioned that using 2-3 years old transactions and considering larger areas could give more trustful results about the final value. On average, appraisers consider approximately 25-30 comparable sales transactions before making decisions dependent on different factors. Concerning the adjustments for timber volume, a
wider range of past transactions could be used especially for running a regression analysis. More about comparable sales adjustments is described in the following part.

6.4.1 Comparable sales adjustments

Time (market conditions) adjustments
All Swedish respondents were concerned about timber prices that are fluctuating unpredictably, having a substantial influence on timberland prices. In order to adjust for the changing market conditions, the respondents use the market price information which corresponds to the theory explained by (California State Board of Equalization, 2007). In practice, half of the respondents claimed to look at the average price per hectare difference, considering all sales from the subject region. The other half of the respondents tried to focus on the representative sample of the comparable sales transactions for capturing the price changes between different time periods. Moreover, all appraisers are constantly updating their price lists that provide useful information about market conditions.

Timber volume adjustments
According to (Healy Jr. & Bergquist, 1994) the logic behind adjustments for timber volume is that, other things being equal, higher volume per hectare sells for greater price which was also supported by the results from the interviews. This relation is illustrated on Graph 24.

In practice, two thirds of the respondents made adjustments for timber volume by using the regression analysis. The regression analysis was used to find the relation between timber volume per hectare and timberland price per hectare.

The rest of the respondents did not mention anything about using specific methods for making volume adjustments. They were rather more focused on finding sales that would match with the subject property by excluding transactions with too low or high timber volumes.

Species mix adjustments
From (Healy Jr. & Bergquist, 1994) revealed that timberland values are influenced by tree species concentration. Respondents also pointed out that different species could have substantial price differences. Four respondents out of six claimed to make adjustments for a species mix. In order to make adjustments for the species mix, it is essential to possess information about the percentage composition of different three species. This further enables
to make adjustments for the dominant species of timber. According to one respondent, in some regions there is only one prevailing type of trees which precludes the appraiser from making any adjustments for the species mix.

**Timber quality adjustments**

The results from the interviews indicated that adjustments for timber quality are rare or not used at all. Some respondents clarified that timber quality adjustments are difficult to conduct and require accurate timber cruise data about different timber grades and species. Latter was also in (Healy Jr. & Bergquist, 1994). In practice, the adjustments for timber quality are left out mainly because of a lack of data or knowledge about the standing timber.

**Stand age adjustments**

(Healy Jr. & Bergquist, 1994) points out that the value of timberland property is influenced by the age of timber growing on the land plot. Notably, merchantable timber is more expensive than immature timber. Due to that, adjustments for stand age are necessary. In the interviews, half of the Swedish respondents claimed that timberland properties with a higher proportion of merchantable timber have higher value. The other half did not find stand age to be an important factor in price determination.

**Site features adjustments**

The production quality of the soil, the accessibility of roads, and the shape of the plot were the most important site features that were pointed out by the respondents. According to (Healy Jr. & Bergquist, 1994), site features are not easily quantifiable and are estimated rather subjectively and depend on the appraiser’s emotions. Different appraisers value site features in differently based on their experience and preferences.

**Transaction quality adjustments**

Adjustments for transaction quality could again be considered relatively subjective according to (Mellette, 2008) and are based on the appraiser’s opinion. In this thesis several factors were pointed out that are important in making adjustments for transaction quality. Namely, these factors were the number of bids, the buyer and seller knowledge and motivation, bid results, adequacy of time allotted, the involvement of a middleman, and the form of payment. On the contrary to the theory, all transactions made beyond arm’s length condition were excluded from the set of comparable sales. The respondents claimed that comparable sales data does
not reflect much information about the deal conditions and other underlying factors and therefore, all suspicious transactions are left out of the set of comparable sales.

**Tract size adjustments**

(Healy Jr. & Bergquist, 1994) described a tendency that larger tracts of timberland are sold with lower price per hectare in comparison to smaller ones. The author’s opinion was that many investors are not capable of purchasing large timberland properties. This leads to a smaller amount of bids and lower prices per hectare. Similar patterns appeared from the interviews when four respondents out of six shared the opinion that smaller properties are slightly overvalued. They explained that private persons who are interested in smaller plots do not consider the timberland’s capability to produce timber as the main matter and thus value other features. People are more interested in hunting areas and having country houses.

**6.5 Implementation of the cost approach**

According to (Viitanen, Hannelius, & Airaksinen, 2006) the cost approach is considered to be suitable for valuing timberland with young stands or for supporting the valuation estimates attained from other valuation methods. The results from interviews, however, found no proof of exploiting cost approach is Estonia or Sweden. Latter is in compliance with (Kobriger, Boone, Weiss, & Chambers, 2011) which states, after examining numerous reports, that the cost approach is not very popular among appraisers.

**6.6 Handling and reporting the uncertainty of market value**

As was found from the interviews, in Estonia as well as in Sweden no uncertainty interval or sensitivity analysis was presented in valuation reports. (Adair & Hutchison, 2005) suggests that one reason why appraisers do not want to use very sophisticated methods for reporting uncertainty is because they do not want to confuse the clients. This phenomenon was also introduced by the interviewed appraisers, for instance some of them pointed out that the valuation is already an approximation and including some kind of intervals does not increase the quality of the estimate of value. Also (Lorenz, Trück, & Lützkendorf, 2006) argued that judgements on whether to present uncertainty in valuations are left to decide by appraisers. In contrary, (Mallinson & French, 2000) explained that when the value estimate is presented as a single figure without explanation, then it causes misunderstanding and could be treated incorrectly by clients and third parties.
7. Conclusion

The empirical and theoretical parts of this thesis have tried to identify how the market value of timberland properties is assessed in Estonia and Sweden and how the appraisers in both countries perform timberland valuations. (PricewaterhouseCoopers, 2009) found that the timberland valuation methods among companies are similar, but the key assumptions in these approaches vary. This thesis shows, however, that the timberland valuation approaches used within a country are similar, but differ when comparing Estonia with Sweden. The phenomenon that the valuation practices between countries and regions can differ is also pointed out in (French N., 2005). Furthermore, this thesis shows similar results with (PricewaterhouseCoopers, 2009) regarding the key assumptions used in timberland valuation approaches - the key assumptions used in valuation approaches vary between countries as well as between companies within a country.

The main research question of the thesis was; how timberland market value is appraised in Estonia and Sweden? In order to reach to a conclusion several sub questions were asked and analysed in Chapter 6. Since the empirical findings and analysis shows that timberland valuation practices in Estonia and Sweden are completely different, the answer to the main research question is presented in two separate parts: timberland valuation practice in Estonia and timberland valuation practice in Sweden.

Timberland valuation practice in Estonia

In Estonia, timberland appraisals are mainly done for transactional purposes, appraising timberland for other purposes is considered to be rare. The research showed that appraisers from regular real estate companies (i.e. companies that appraise condominiums, land, commercial real estate, etc.) do not appraise timberland properties by themselves due to lack of knowledge and experience and outsource the timberland appraisal service.

The income method is the only valuation method used to value timberland in Estonia. Since the forest management plan is made for a ten year period, all the appraisers use a ten year income model. There is consensus about what costs and incomes to consider in the income approach. The income comes from selling timber as pulpwood or logs in different assortments, whereas the costs come from harvesting, forwarding, transportation and replanting.
The income is calculated through current timber price information acquired from local sawmills or timber buying companies. Appraisers have unit prices for a range of assortments. Usually there are 10-20 assortments on the list that contain prices for logs, pulpwood and firewood depending on species, dimensions and quality.

The way the income approach is carried out is substantially different among appraisers. A third of the appraisers use the classical income approach, in which the future cash flows are discounted into present, whereas two thirds do not discount future cash flows at all and consider the future cash flows as if occurring at the valuation date. Two thirds of the appraisers also take into account the value of premerchantable timber, whereas one third omits the value of premerchantable timber.

Only third of the appraiser discount future cash flows in the income approach, the rates applied are 3% and 4.5% pre-tax discount rates. In all cases the same discount rate was used and the basis of the discount rates is vague or absent.

The appraisers do not perform any sensitivity analysis and do not include market value uncertainty interval in the appraisal report.

Timberland valuation practice in Sweden

Timberland valuations among the appraisers interviewed, are mainly done for compensation purposes (i.e. in order to compensate to owner for building infrastructures or nature reserves). The appraisers use the comparable sales method as well as the income approach. The comparable sales approach is considered as the main timberland valuation method. The choice of valuation method does not depend on the type of timberland under valuation, but rather on the availability and quality of the data regarding the property being valued. Nevertheless, all the appraisers always use the comparable sales method and stand method together, but the final decision could be made by preferring one method to another.

The income approach is used through computer aided software called BM-win. This software is based on the cash flow analysis that calculates the value from the perpetual periods of incomes and costs. Several field conditions are determined by the appraiser and inserted to the program. Operations like thinnings, final cuttings and other silviculture activities are projected to the future based on the information in forest management plans. Future incomes and costs
that appear at different points of time are discounted to the present with the discount rates selected by the appraiser.

Regarding the income, timber volumes are fed into the program along with a price list for different assortments, which allows calculating incomes from thinnings and final cuttings. The excess income that comes from hunting activities cannot be added via the program but it will be added to the final value. Regarding the costs, the BM-win model has several ways of estimating all the costs related to harvesting, forwarding, transportation, scarification, replanting, regeneration, management or other activities. The task of the appraisers is to select the appropriate costs and assign the right unit prices, which depend on the region.

Timber price information is generally obtained from the direct communication with partners, who are timber buyers in smaller regions, or with big companies that hold bigger market shares. The appraisers use current price information in their calculation, which they have gathered into different price lists that represent a particular region.

All the appraisers use pre-tax discount rates in appraising timberland. The discount rates vary from 2% to 5% depending on the region and the age of the stand. The appraisers use two different discount rates, whereas the higher one is used for discounting older stands and the lower is used for younger stands. Older or mature stands are discounted with a higher rate, because older trees are considered to be more risky due to storm damages, bugs and other loss. The discount rates are calculated by using the market information about recent transactions and current prices.

In the comparable sales approach, the appraisers use approximately 30 comparable sales in order to get supporting background information about recent sales. The amount of comparable sales depends on the area where the subject property is situated. Information about transactions is obtained from real estate brokers and agencies. The appraisers have their own transaction databases, which have a fundamental role in the comparable sales approach.

Comparable sales transaction prices are adjusted according to several factors, including time, timber volume, species mix, stand age, site features, transaction quality and the total size of the property. The most important and frequently conducted adjustments are time adjustments and volume adjustments. Also stand age adjustments and species mix adjustments are considered to have influence on value of timberland, and therefore, conducted quite
frequently. Adjustments for site features as well as for transaction quality are also considered important, but making adjustments for these factors is rather subjective. For instance, transaction quality features are generally not adjusted, but all transactions made beyond arm’s length condition are excluded from the set of comparable sales.

None of the appraisers use uncertainty intervals in their valuation reports, mostly because banks and clients do not like these intervals. In addition to that none of the appraisers conducted a sensitivity analysis for the value estimate.

The above conclusions about timberland valuation as well as the analysis in Chapter 6 shows that there are significant differences between the valuation practices in Estonia and Sweden. The timberland valuation practice in Sweden is, to a great extent, consistent with scientific theory, furthermore, there is clear solidarity with regards to the valuation methods and most of the assumptions used in these methods. The timberland valuation practice in Estonia, however, is inconsistent with the scientific theory about timberland appraisal. Additionally, there seems to be no solidarity concerning the valuation method and assumptions therein.

The consistency and solidarity of Swedish timberland valuation practice results from the existence of the guidelines and recommendations along with the valuation program provided by the National Land Survey of Sweden. Latter is a clear sign of the importance of valuation standards and guidelines. Current international valuation standards, which act as an umbrella for countries such as Estonia, contain little guidance about timberland valuations. As argued in (Viitanen, Hannelius, & Airaksinen, 2006), forest properties should have completely independent and specified valuation guidance.

Further research should focus on making the currently used valuation methods more accurate, especially in Estonia. It would be also interesting to see how much value estimates differ when using the method that is common among Estonian timberland appraisers and the methods that are used in Sweden. Thus the question for further researchers is following; is timberland undervalued in Estonia?
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Appendices

Appendix 1. Interview questions

General questions

1. How many years of experience do you have in timberland valuations?
2. How many timberland valuations does the company you work for conduct every year?
3. What are the purposes of timberland appraisal?
4. What kind of different valuation approaches have you used for valuating timberland?
5. Which of the two approaches do you think is the main valuation approach when valuing timberland, income or the comparable sales approach? Why?
6. Valuing different types of timberland: are different methods preferred in valuing different types of timberland? If yes, then how?
7. Do you use more than one valuation method to reach to the market value conclusion or do you control the main method with some other method?

Income approach

8. What is the number of periods (years) in the income model that is used for valuing timberland or do you use a perpetuity model?
9. What kind of costs and revenues do you take into account in the income approach?
10. What pre-tax and post-tax discount rates do you use? Give numbers!
11. What is the basis of the discount rate?
12. How do you determine and where do you get information about timber prices and costs for harvesting, transportation, replanting, etc.?
13. Do you use different discount rates for valuing stands with different ages?

Comparable sales method

14. What adjustments do you make in sales comparison approach?
15. How many comparable sales do you consider before making any decisions?
16. Where do you get information about comparable sales?
17. On which basis do you make time adjustments?
18. How do you make volume adjustments?
19. How do you make species mix adjustments?
20. How do you adjust for timber quality?
21. How do you adjust for stand age?
22. What kind of site features do you take into account in site features adjustments?
23. What kind of factors do you consider in the case of transaction quality adjustments?
24. How do you adjust for the total size of the property?
Cost method

25. Have you used the cost approach to value timberland?
26. Is cost method preferred for valuing specific type of timberland?
27. How do you calculate the value of bare land?
28. Is this method used accompanied with other methods?

Valuation reports

29. Is it your opinion that the market value in a valuation should always include an uncertainty interval?
30. What kind of sensitivity analysis (which parameters are tested) do you perform in your valuation process?

Other

31. What value does the land have when a clear cut has been made (value for bare land)?
Appendix 2. Stand method
Source: National Land Survey of Sweden

STANDMETHOD FOR FOREST VALUATION

The modern computer aided system for the forest valuator

BM
win
Standmethod

When buying/selling forest property it is necessary to be able to perform correct valuations of the forest. It is equally important when preparing basis for credit granting, during reallocation or when compensation levels at property encroachment are to be set. The valuator must cover numerous factors affecting the market value.

TWO VALUES
The factors affecting the value of a forest property can be divided in two categories. Forest – the production ability of the land and the current forest potential monetary yield, and Market – the relation between seller and buyer. Therefore two different values are discussed; yield value and market value. The yield value is calculated using the expected incomes and costs for the property in question. The market value is later depending on how the yield value plus market factors such as the location, settlements and game value etc. correlates with the intending buyers economical potential.

A FLEXIBLE SYSTEM
The stand method is, as indicated by the name, a valuation method based on the individual stand. The method is personal computer aided and called BM-win (in Swedish “Bestånds Metoden”) and it is a very flexible system. The stand is extrapolated based on the field conditions estimated by the valuator. Thinnings, final fellings and silviculture management measures are simulated in two generations from today. The first generation forest is the existing stand. This generation is extrapolated to the final felling. The valuator can decide the maintenance of the stand during the coming 30 years. The yield of timber and pulpwood is priced according to price lists in the system given by the valuator. The costs for felling and silviculture management are calculated in a similar way. Ration according to the Swedish Silvicultural Law or according to an own alternative can be selected in the program.

CALCULATION OF THE PRESENT VALUE
The final step is to calculate the present value. Incomes and costs appearing in different time periods are weighted using an interest factor (discount percentage). The valuator gives the discount percentage. The present values for the individual stands are accumulated to the total present value of the property.
LINKING TO BM-WIN
Conversion programs from common forest management plans, databases and field computers to BM-win have already been developed, e.g. “pcSkog”, forest company stand lists, County Forestry Board planning programs, etc.

THE USER
All major players in the Swedish valuation market use BM-win. Users are to be found at County Boards, County Forestry Boards, Forest Owners Association, consulting companies, etc. Possibility of education can be found at all high-level forest institutes.

The additional information, apart from the stand data, required by BM-win to perform the valuations are as follows:

- Valuation prerequisites
- Timber prices
- Cost for cutting
- Off-road extraction costs
- County table
- Quality table
INPUT
- Forest management plan
- Stand lists
- Field computer

COMPUTING
- Increment
- Yield
- Gross value
- Logging cost
- Tending cost
- Discounting

RESULT
Present value for the property

SYSTEM REQUIREMENTS
The software is developed for PC users. Minimum system requirements: Pentium processor, 32 Mbyte RAM, 35 Mbyte available on the hard drive. Windows 2000, NT 4, XP or Vista. The software is distributed on CD-ROM with accompanying user documentation (only in Swedish).

CUSTOMER SERVICE AND SUPPORT
The National Land Survey of Sweden is responsible for customer services covering BM related questions regarding the software or computer problems. The National Land Survey of Sweden is supplying new releases of the program and issues yearly recommendations (price level) and forecast figures (price development) for valuations using BM-win.

TRAINING
The National Land Survey of Sweden is conducting yearly courses in BM-win. The course Stand method basics (2 days) is targeting new users of the forest valuation program BM-win. For further information regarding the courses please contact the Swedish National Land Survey course administrator at the Cadastral services Division Tel. +46-26-63 30 60.
CONTINUOUS DEVELOPMENT
The National Land Survey of Sweden is continuously developing BM-win. The method is adapted to changes in the silviculture maintenance, timber market and new research in order to be able to optimally describe the value generating factors. A user group consisting of people from Silviculture Organisations, Forest companies and Forest Owners Association has been founded in order to guarantee the development of BM-win.

BM STRUCTURE
A special version, BM structure, is used by some County Cadastral Authorities at land consolidation projects.

PURCHASE AND ORDERS
A purchase of BM-win gives the right to use the system, to customer support and to software updates during the contracted period.

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