CHALMERS
UNIVERSITY OF TECHNOLOGY

Key Pricing Factors and Underlying Mechanisms for Wood Packaging in Sweden: A Case-Based Analysis

Master's thesis in Management and Economics of Innovation & Supply Chain Management

GEORGE FORSBERG
JULIA HENRYSSON

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS
DIVISION OF SUPPLY AND OPERATIONS MANAGEMENT

CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2025
www.chalmers.se

Key Pricing Factors and Underlying Mechanisms for Wood Packaging in Sweden: A Case-Based Analysis

GEORGE FORSBERG
JULIA HENRYSSON

Department of Technology Management and Economics
Division of Supply and Operations Management
Chalmers University of Technology
Gothenburg, Sweden 2025

Key Pricing Factors and Underlying Mechanisms for Wood Packaging in Sweden: A Case-Based Analysis

George Forsberg
Julia Henrysson

Supervisor: Sandra Brüel Grönberg, Department of Technology Management and Economics
Examiner: Kajsa Hulthén, Department of Technology Management and Economics

Department of Technology Management and Economics
Chalmers University of Technology
SE-412 96 Gothenburg
Sweden
Telephone +46 31 772 1000

Gothenburg, Sweden 2025

Key Pricing Factors and Underlying Mechanisms for Wood Packaging in Sweden: A Case-Based Analysis

GEORGE FORSBERG
JULIA HENRYSSON

Department of Technology Management and Economics
Chalmers University of Technology

Abstract

In recent years, global trade has experienced disruptions which have affected the supply of commodities. This has increased the price volatility of these commodities, creating uncertainties regarding future prices. One commodity that has experienced increased price volatility is wood, particularly in Sweden. The increased price of wood in turn affects the price of wood products, including packaging. To mitigate the uncertainties associated with price instability, it is important to understand the key factors influencing price fluctuations.

The aim of this thesis is to identify the key pricing factors of wood packaging and to analyse how underlying mechanisms within each of these key factors affect pricing, based on wood packaging used within the case company. The thesis presents a frame of reference based on theories about market factors of commodities, including supply and demand, macroeconomic conditions, competition, market integration, and regulations. This study utilises a case study approach, and the empirical data has been collected through interviews with respondents at the case company, as well as industry experts, supported by market reports and company documents.

The study resulted in the identification of key pricing factors affecting wood packaging and an analysis of the underlying mechanisms shaping these factors in the context of the Swedish wood market. The findings show that pricing is influenced by a combination of supply constraints, global demand growth, export dependency, power dynamics, price discrepancy, and regulatory developments, all of which interact in a highly complex and often unpredictable market environment. Both domestic conditions, such as ownership structures and value chain integration, and global factors, such as currency fluctuations and geopolitical events, play a critical role in shaping pricing dynamics. These insights deepen the understanding of price formation of wood and highlight challenges and opportunities relevant to both the case company and broader industry contexts.

Keywords: Wood Packaging, Swedish Wood Market, Market Analysis, Pricing Factors, Wood Prices, Price Volatility

Acknowledgements

We would like to express our gratitude towards the case company for the opportunity to conduct this thesis in collaboration with you. A very special thanks to our supervisor at the case company who continuously has provided great support and guidance during the thesis. We are grateful for your high involvement in the thesis and for the input you have provided during the entire project.

We would also like to thank our supervisor at Chalmers University of Technology, Sandra Brüel Grönberg, for valuable discussions and for your willingness to support us throughout the thesis. Your expertise and constructive feedback have clearly helped us navigate through the project and enriched our work.

Finally, we would like to express our gratitude to all interviewees who devoted their time and were willing to share their insights and knowledge on the topic of this thesis. Your participation has made clear contribution to the thesis and helped us navigate as the project evolved.

George Forsberg & Julia Henrysson, Gothenburg, June 2025

Contents

List of Acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

CHP	Combined Heating and Power Plant
CLT	Cross-Laminated Timber
EU	European Union
EUDR	European Union Deforestation Regulation
EUTR	European Union Timber Regulation
GDP	Gross Domestic Product
LNG	Liquid Natural Gas
LULUCF	Land Use, Land Use Change and Forestry
MENA	Middle East and North Africa
RED	Renewable Energy Directive
SEK	The Swedish Currency
US	United States

List of Figures

List of Tables

1
Introduction

This chapter introduces the topic of this thesis by providing a background that outlines the context and issues to be addressed. It also presents the study's aim, followed by the thesis's limitations and the research questions addressed.

1.1 Background

During the past decade, the global commodity and raw material market has undergone changes driven by economic, geopolitical, and environmental factors. Historically, the market has experienced cyclical patterns that are heavily influenced by economic growth and changes in global demand (Zapata et al., 2023). In addition, each commodity or raw material market is shaped by a unique set of underlying mechanisms that impact supply, demand and overall price stability. Mechanisms such as policy changes, production constraints, global trade shifts and environmental conditions all contribute to price fluctuations across different markets. In addition, events such as the COVID-19 pandemic and the Russia-Ukraine war have caused unanticipated disruptions in supply chains and demand patterns, leading to price fluctuations and increased volatility in various commodities (Boungou & Yatié, 2024). These changes in the raw material market have influenced companies and their purchasing strategies (Nnaji et al., 2024). The increased volatility and unpredictability of commodity prices have required a shift toward more dynamic and adaptive procurement practices for businesses. Companies now need to closely monitor market trends, forecast price fluctuations, and build resilience within their supply chains.

One of the commodities that has experienced significant price fluctuations in recent years is wood, which has become an increasingly important resource in the global shift towards sustainable and renewable materials (Hurmekoski et al., 2018). As demand for wood-based products grows, particularly in construction, packaging, and energy production, these markets have become more sensitive to supply constraints. In addition to this, there are other challenges related to the wood industry, such as harvesting restrictions and environmental policies, leading to a complex landscape in which actors operate (Jonsson, 2024). One of the markets where there has been a noticeable increase in price volatility in recent years is the Swedish wood market, as illustrated in Figure 1.1. The volatility is driven by both domestic and global factors as Sweden's wood industry is highly export-oriented. For Swedish companies within the wood industry, wood is sourced predominantly from domestic markets, but approximately 80% of wood products are directed to export markets

(Skogsindustrierna, 2024). This heavy dependence on exports exposes the Swedish wood industry to fluctuations in global demand and market conditions, making it particularly vulnerable to international price changes and supply chain disruptions. As a result, stakeholders in the Swedish wood market must navigate an increasingly unpredictable environment, balancing domestic sourcing with the pressures of global market dynamics.

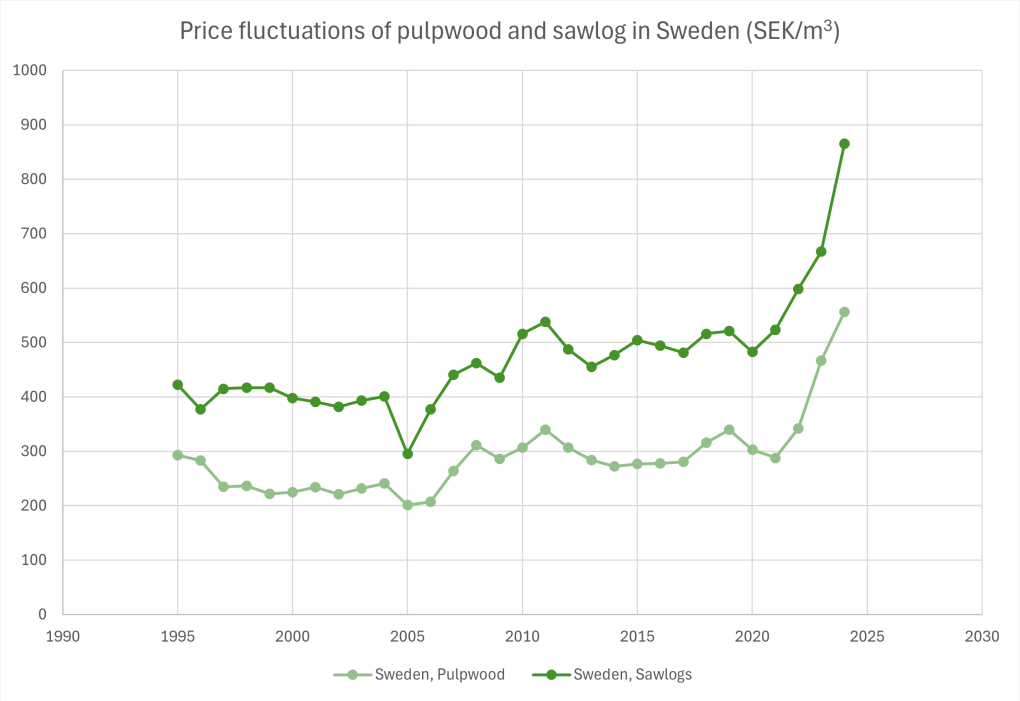

Figure 1.1: Price fluctuations of pulpwood and sawlogs in Sweden (Skogsstyrelsen, n.d.-b)

In the manufacturing industry, raw materials play a fundamental role in enabling the production of various products. Raw materials directly impact companies' product cost, quality, and sustainability, all of which are critical for maintaining a competitive edge. Beyond their role in production, raw materials are also essential in the packaging used within manufacturing facilities and the overall logistics flow. Wood is a vital component in the packaging solutions used by the case company to transport parts and products globally, including a reusable packaging system. The reusable modular container system is designed to support logistics efficiency by offering stackable, foldable and recyclable packaging solutions. Due to the importance of wood in the case company's operations and the increasing impact of raw material price fluctuations, it is crucial to understand the factors behind wood pricing related to the wood packaging market. As wood is considered a renewable resource, the demand is expected to increase as a result of various industry actors acknowledging the importance of implementing sustainable practices and materials (Henriksson et al., 2021). This has implications for actors such as the case company, and given the critical role of wood packaging, the wood market needs to be closely monitored to ensure reliable supply and pricing in line with the market.

1.2 Aim

This thesis aims to identify the key pricing factors of wood packaging and to analyse how underlying mechanisms within each of these key factors affect pricing, based on wood packaging used within the case company.

1.3 Limitations

The limitations of this thesis are primarily related to the case company and its purchasing activities related to wood packaging. By concentrating on one organisation, the findings will focus on the price of wood related to the packaging used by the case company. The result might therefore reflect specific practices, challenges and market conditions faced by this organisation. The primary focus of the thesis will be the Swedish wood market as the case company sources a major part of its wood from Sweden. However, the Swedish wood market is part of the global market and is therefore affected by global changes and variations in supply and demand.

1.4 Research Questions

In order to fulfil the aim of the thesis, the use of wood packaging within the case company will first be outlined to provide context. This includes mapping the wood packaging flow and identifying the key supply markets in the case company's wood packaging sourcing process. As a result, this helps to examine which markets will serve as the basis for the wood market analysis, which turned out to be the Swedish market. Based on the background and aim of the thesis, the following research questions are to be addressed:

RQ1: *What are the key pricing factors of the wood packaging used by the case company?*

RQ2: *How do underlying mechanisms of these key factors affect the pricing?*

2
Frame of Reference

This chapter provides a frame of reference that will support the collection and analysis of the empirical data. It includes a brief historical background and general information about how commodities are exchanged. Further, the market factors of commodities discussed in the literature are explained, covering supply and demand, macroeconomic conditions, competition, market integration, and regulations.

2.1 Commodities

Commodities are goods sold, as they are found in nature, for either production or consumption (European Commission, n.d.-a). There are different ways to classify commodities depending on the purpose of the classification. European Commission (n.d.-a) writes that the Standard International Trade Classification distinguishes five categories of commodities as presented in Table 2.1: Food and live animals (Section 0), Beverages and tobacco (Section 1), Crude materials, excluding fuels (Section 2), Mineral fuels (Section 3), and Animal and vegetable oils, fats and waxes (Section 4). Sections 0 and 1 can be grouped as Food and drinks, while Sections 2 and 4 can be grouped as Raw materials. Section 2 includes wood and additional materials such as crude rubber, cork, pulp and metalliferous ores and metal scrap (United Nations, 2006).

Table 2.1: *Categorisation of commodities (United Nations, 2006)*

Section	Category	Group
0	Food and live animals	Food and drinks
1	Beverage and tobacco	Food and drinks
2	Crude materials, excluding fuels	Raw materials
3	Mineral fuels	
4	Animal and vegetable oils, fats and waxes	Raw materials

2.1.1 Development of Commodity Markets

With some exceptions, most countries' economies undergo the same shifts, from agricultural to manufacturing and then to a service economy. Initially, the share of the economy that derives from the output created from agriculture, mining and utilities has a significant decline as the country's economy develops (Radetzki &

Wårell, 2016). The primary reason for this decline is that countries experience a downward trend in their agricultural sector. At the same time, the rest of the economy continues to grow, measured in gross domestic product (GDP). Radetzki and Wårell (2016) notes that the mining industry does not follow the same pattern, and in some cases, its share of the economy remains proportional to its overall growth. This development of countries' economies follows a broader pattern of economic development, as increased productivity increases resource efficiency, leading to reduced demand for raw materials and a shift in focus towards value-adding activities. This development reduces the demand for the domestic production of commodities. Radetzki and Wårell (2016) state that the essence of economic growth is to move towards products with a higher value per kilogram. There are some exceptions to this pattern, i.e., Norway, which has abundant high-value natural resources. However, Radetzki and Wårell (2016) argue that, in recent years, with the increasing demand for rare earth metals, it has become clear that even the most modern economies depend on what raw materials they can use as input.

Developed economies experienced a decrease in demand for domestically produced commodities due to lower transportation costs as importing commodities got cheaper, as noted in (Radetzki & Wårell, 2016). Additionally, Radetzki and Wårell (2016) argue that lower tariffs and increasing globalisation have also been important factors in why the prices decrease. During the second half of the 20th century, freight ships that loaded low-value products such as iron ore, steam coal, and oil more than quadrupled in size. The development of freight ships decreased the demand for European commodities, as these raw materials could be bought and transported at lower prices elsewhere. This led to production being relocated to countries where the production costs were lower. An exception to a raw material that did not experience the same effect was liquid natural gas (LNG) because of the cost and difficulties in transporting large quantities, as Radetzki and Wårell (2016) argue. This created three local markets for LNG, where the natural gas price varied considerably.

The commodity industry has experienced several different periods of governmental intervention during the 20th century. For example, Radetzki and Wårell (2016) describe how the Soviet Union actively participated in interventions in the international commodity market. Bilateral agreements were signed where the Soviet Union imported the whole export of specific commodities from developing countries to gain political influence. Sometimes, the Soviet Union resold the quantities in other markets, thereby suppressing the prices for exporters' sales outside the agreement, creating a disadvantageous deal for the selling country. Another example of market intervention is how the US created strategic tin stocks after the Second World War to be self-sustaining in case of supply chain disruptions. Subsequently, the US government decided its tin buffer stock was too large and sold off the excess. This created severe instability in the market as it increased the supply of tin on the market by 10% (Cooper et al., 1975). The Organisation of the Petroleum Exporting Countries is another example of an intervention in commodity markets where a number of the largest oil-producing countries organise to keep the oil price high. Radetzki and Wårell (2016) states that during the 20th century, the commodity market experienced a considerable number of interventions. The beginning of the

21st century has seen a shift towards more liberal attitudes regarding commodity trade and production. However, there has been an increased interest in handling commodities with government interventions. This could increase the volatility of commodity prices.

The demand for raw materials has increased since the beginning of the 20th century (Radetzki & Wårell, 2016). Emerging economies make a considerable contribution to this. According to the IMF (2015), China, India, Brazil, Thailand, and Vietnam are examples of emerging economies. Countries like China and India have experienced a large GDP per capita growth, doubling in 12 and 16 years, respectively. Compared to the United Kingdom, which doubled its GDP per capita during the Industrial Revolution, a period lasting approximately 150 years. As the global middle class grows, especially in Asia, the geographical centre of raw material consumption will move, and therefore also the production (Kharas, 2010). According to Radetzki and Wårell (2016), the commodity market experienced a boom at the beginning of the 21st century, and the demand from the growing middle class will keep it at an elevated level for years.

2.1.2 Commodity Exchange

Commodities are sold in various trading agreements. The most common one is bilateral contracts, but commodities are also traded through auctions and on commodity exchanges (Radetzki & Wårell, 2016). Bilateral agreements are independently agreed upon between two actors. This can result in a wide range of prices, as contractual agreements are not publicly disclosed. However, in practice, actors often utilise price levels set by commodity exchanges or specific contracts between two influential actors that act as a guideline for other contracts on the market. Commodity exchanges are centralised markets where physical commodities or commodity instruments can be bought and sold under a set of predefined rules and regulations (Rashid, 2015). Commodity exchanges improve price transparency, strengthen market liquidity, and improve price risk management. Historically, the most important commodity exchanges have been located in Chicago, London, and New York (Tilton et al., 2011). Over time, however, the dominant centres have gradually moved towards Asian markets, including China, India, and Japan (Radetzki & Wårell, 2016). Further, the authors explain that commodities that do not trade on commodity exchanges commonly require more negotiations to find an agreement at a fair price. According to Radetzki and Wårell (2016), there are five conditions that a commodity needs to satisfy for it to function well on commodity exchanges.

1. There needs to be a sufficient number of both traders and sellers that provide a proportionate amount of liquidity.
2. The producers and traders of the physical product need to use the market for hedging, while speculators provide deals that match these.
3. There needs to be an inherent variability of the commodity's price, together with an inherent low price elasticity.
4. The commodity's quality must be easily determined to specify the material's quality and characteristics in future contracts.

5. The commodity needs to be storable to establish a relationship between futures options and spot prices.

Markets for trading commodities and raw materials have existed in different countries of various sizes and sophistication levels (Radetzki & Wårell, 2016). However, the first modern futures market evolved in Japan in the early 18th century, where rice futures were traded (Anderson et al., 2001). Futures contracts were developed to create a way for producers to hedge some part of their production against the market. This theory is called normal backwardation, formulated by Keynes (Erb & Harvey, 2006). Commodity futures are not directly exposed to physical commodities, as spot prices are, but are an agreement to buy or sell a specified quantity for a predefined price at a given date. However, these are linked as the prices of commodity futures represent speculations of expected future spot prices of that commodity (Erb & Harvey, 2006). Commodity futures are commonly used in hedging to decrease future risk. This allows commodity-producing companies to hedge against unfavourable price fluctuations. Since this mechanism functions as insurance for the commodity price, speculators must be offered a premium for the risk they take on. This means there is a relationship between the current spot price and the expected future spot price, with inventory decisions of current and future scarcity of the commodity.

2.2 Market Factors of Commodities

The prices of commodities are affected by several different market factors. Researchers have used the perspective of supply and demand and macroeconomic fundamentals, including uncertainties such as shocks and commodity financialisation, to analyse the price changes in commodities (Hu et al., 2020). Additionally, competition, market integration and regulations are important to investigate to understand the price movements of commodities (Jena, 2016; Kowalski & Legendre, 2023; Redmond, 2013). The market factors found in the literature are presented in Figure 2.1, and the following section will describe the market factors and how they affect commodities.

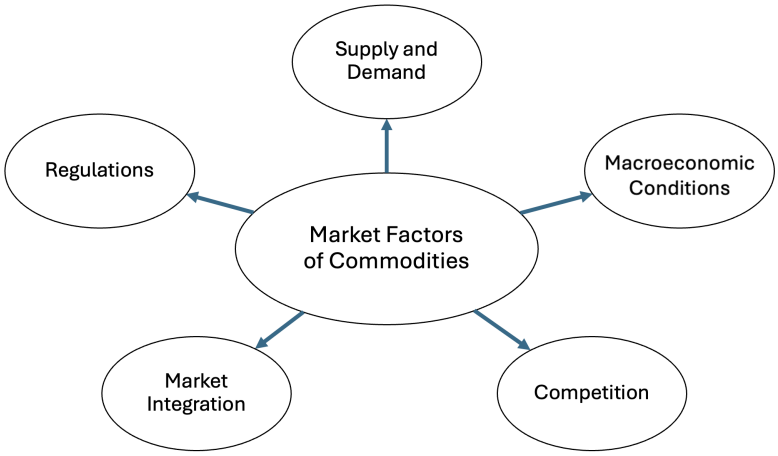

Figure 2.1: Market factors of commodities

2.2.1 Supply and Demand

The availability of goods and services is directly related to the concept of supply, while consumption is related to demand. The concept of supply and demand is central in the studies of commodity prices and their movements (Deaton & Laroque, 1992). As for all industries, supply and demand dynamics influence pricing in various ways, striving to reach an equilibrium. Historically, fundamental market forces such as supply and demand have been viewed as the main drivers when it comes to the movement of commodity prices (Wu et al., 2020).

Commodity prices are volatile, however, the degree of volatility varies over time (Pindyck, 2004). Pindyck (2004) argues that volatility affects the production, prices and inventories, and in turn supply and demand, in two fundamental ways. Firstly, it affects the marginal value of storage, i.e., the advantages of having an extra unit in the inventory. Volatile commodity prices consequently affect production and demand. In response to price fluctuations, companies may seek to secure stable production and deliveries, thereby increasing demand. Hence, volatility can raise prices and lead to the accumulation of commodities in inventory. Secondly, volatility directly affects the total marginal production cost for depletable resources through the option premium. The option premium is the price paid to acquire an option contract, it can either be a call option or a put option. A call option gives the buyer the right to purchase an asset for a certain price before a set date. A put option gives the buyer the right to sell an asset at a specified price before a predetermined date. Commodity producers can therefore hold a put option with an exercise price equal to the marginal cost of production, where the current spot price determines the payoff. This is to secure that the losses are limited for the producers of the commodity. In this context, the total marginal production cost comprises both the opportunity cost of exercising the operating option and the direct marginal cost. Due to the option premium, volatility raises the likelihood for the option to become a profitable position, which in turn drives the price of the option contracts, i.e. option premium (Pindyck, 2004). As a result, the associated opportunity cost increases, which in turn can result in reduced production.

Jacks and Stuermer (2020) argues that an increased commodity demand can trigger two processes, investments in new mineral deposits or expanding into new arable land, or productivity increasing technology to increase production capacity. Therefore, the demand changes for commodities, such as rapid industrialisation and urbanisation, affect not only the global GDP but also the production of individual commodities. Jacks and Stuermer (2020) also claim that supply shocks, i.e. disruption in physical production such as natural disasters or strikes, only affect the global economy temporarily. They conclude that aggregated commodity demand shocks are a more common reason for increases or decreases in commodity prices than commodity supply shocks. The most common shocks are inventory demand or specific commodity demand, which drive 46% of the price changes (Jacks & Stuermer, 2020).

The theory of storage describes the connection between commodity inventories and future and spot prices (Erb & Harvey, 2006). Gorton and Geert Rouwenhorst (2006) states that the link between the level of commodity inventories and the

term structure of future prices can be explained by the cost of carry arbitrage, meaning that since storing goods incurs cost, these costs need to be compensated. This results in the future and expected spot prices of commodities having to rise over time. An extension to this theory has been proposed by Deaton and Laroque (1992), which predicts a linkage between future spot price volatility and inventory levels. Inventories can act as a buffer stock to absorb supply and demand shocks to reduce the impact on spot prices. The authors present an increased risk for stock out as well as an increased volatility of the future spot price at lower inventory levels.

Hu et al. (2020) argue that an increased number of speculators, hence an increased demand for financial instruments of commodities in the commodity markets, increases the volatility of the commodity prices. Similarly, Tilton et al. (2011) states that there is a connection between commodity prices and demand caused by the influx of investors and speculators. However, they argue that the price movements depend on whether the spot prices are in a strong or weak contango. A strong contango means that the commodity's futures price is higher than the spot price by at least the associated cost to hold the asset. Weak contango implies that the futures price is above the spot price, but not with amounts that cover related costs such as storage and interest costs. During a weak contango, the connection between the price movements of futures and spot prices is considerably lower. Instead, during these periods, changes in economic fundamentals determine the spot prices (Tilton et al., 2011). While both Hu et al. (2020) and Tilton et al. (2011) argue that the increased financialisation of commodities has increased the volatility of the prices, they disagree on how significant the correlation with the stock market is and when it is in effect.

To summarise, commodity prices are driven by supply and demand dynamics. These dynamics are affected by volatility, which raises storage value and production cost, affecting production, inventory levels, and prices. Demand and supply shocks also tend to drive price changes. Additionally, financial speculation has amplified the volatility of commodity prices. However, its extent depends on current market conditions.

2.2.2 Macroeconomic Conditions

Since commodities are not isolated economic assets and resources, they are influenced by various changes in the broader economic landscape. The price of commodities is affected by changes in various macroeconomic fundamentals such as inflation, interest rates, currency exchange rate and changes in GDP (Akram, 2009; Erb & Harvey, 2006; Hess et al., 2008; Hu et al., 2020). Therefore, it is important to understand how changes in these fundamentals affect the fluctuations of commodity prices.

Inflation is a general increase in the price levels in society and the fall of money's purchasing value (Sveriges Riksbank, 2024). The most common situation for a general price increase is when the demand is high and the economy is in an expansion phase, which is also the case for commodities. An increase in the price of commodities greatly affects inflation because a large part of the economy is composed of

commodities. According to Erb and Harvey (2006), the composition of the consumer price index in the US in 2003 was 40% commodities and 60% services. Furthermore, the authors state that it is difficult to thoroughly understand volatility by analysing financial factors. However, inflation is a starting point for understanding the drivers. Erb and Harvey (2006) analyses how different commodities behave when exposed to expected and unexpected inflation. Their analysis displays that different commodities behave differently when exposed to expected and unexpected inflation, meaning that the ability to hedge against inflation with commodities depends on the specific composition of assets. The best commodities to hedge against inflation are those that are difficult to store, such as copper, heating oil and cattle. Hess et al. (2008) analysis has a similar conclusion that an announcement of higher inflation can also affect the commodity's price in an upward direction. Further, they argue that commodity prices are correlated with inflation and therefore a better way to hedge against inflation than stocks and bonds.

The ability to adjust interest rates is a vital tool for governments and central banks to regulate economic growth and maintain stability in the financial system. The short-term interest rates and their anticipated path, set by the Federal Reserve, affect the stock market, the dollar exchange rate and other asset prices (The Federal Reserve, 2021). As previously mentioned, an announcement of higher inflation affects commodity prices upward. However, this usually leads to higher interest rates to curb inflation, which in turn decreases the commodity prices (Hess et al., 2008). Therefore, as interest rates increase, the price of commodities tends to decrease. There are two reasons presented by Hess et al. (2008). Firstly, storage costs increase with higher interest rates, which increases the amount of commodities in the market. Secondly, other financial assets on the market become more attractive than commodity contracts. However, the strength of this effect depends on the state of the economy, specifically whether it is in a recession or an expansion phase. Hess et al. (2008) claim that these signals are strongest during a recession, which implies that commodities are more valuable as a hedge against macroeconomic risk during these periods. Akram (2009) also claims that there is a relationship between commodity prices and interest, especially when it comes to demand shocks.

In some countries, the value of their currency is closely tied to the prices of specific commodities they produce. As a result, the value of their currency is also linked to the global commodity price. This phenomenon is called commodity currencies (Clements & Fry, 2008). This causes a general boom in commodity prices, which will improve the terms of trade for a commodity producer in such a country. If the currency is a commodity currency, then an appreciation in the exchange rate of that currency, i.e., an increase in its value, subsequently increases the world price of that commodity. Clements and Fry (2008) states that when a country is a dominant exporter of a specific commodity, an increase in production lowers the global commodity price due to its market power. The size of this effect, however, depends on the demand elasticity for this commodity. Akram (2009) agrees with the previous author and states that shifts in demand and supply of commodities impact the price. However, the size of the effect depends on the price elasticity. Commodities are generally considered relatively price inelastic, which makes the impact larger

(Akram, 2009). The author explains that as the value of the dollar increases, commodity prices denominated in dollars tend to decrease, which follows the law of one price (Akram, 2009). This economic principle states that identical goods should sell for the same price across different markets, assuming no transaction costs or trade barriers. Therefore, if the dollar depreciates, the dollar price of the commodities must increase to maintain consistent pricing across markets. Otherwise, an arbitrage situation, i.e. the process of exploiting price differences across markets by buying goods at a lower price in one location and selling them at a higher price in another, could arise. Therefore, a weak dollar makes buying commodities cheaper for foreign customers. This results in a global demand increase for commodities, pushing prices upwards. However, this may reduce the demand and, in turn, the returns of the foreign commodity producers and possibly their supply.

Most commodity prices move in tandem with the general business cycles. However, some commodities, e.g. gold and energy commodities, move directly in the opposite direction due to their status as secure assets during recession (Kucher & Kurov, 2014). Higher economic activity than expected has an increasing effect on the prices of the commodities, due to the increased demand for input goods for increased production levels (Hess et al., 2008). When demand rises while the supply remains constant, prices will escalate. If there is a global trend of growing demand, it might shift the supply curve's equilibrium point to its inelastic region. Conversely, the opposite effect occurs when actual economic activity falls short of expectations. The impact of the economic cycles is also dependent on the commodity monitored. Similarly to the observed effects of inflation rates, the impact of the economic cycles is also dependent on the commodity monitored. According to Powell et al. (2019), agricultural commodities have an increasing demand during an expansion phase and a decrease during a contraction phase. Compared to those commodities, metals and oil show more noticeable price fluctuations due to their prices being more elastic and closely tied to the condition of industries (Kablan et al., 2017).

2.2.3 Competition

Competition is a key feature of market economies that significantly impacts market outcomes, such as prices and the availability of goods. By understanding the competitive structure of a market, firms can develop strategies that enable them to navigate and operate successfully in a certain market (Arnett et al., 2021). In basic terms, competition occurs when multiple sellers offer the same type of goods to a specific group of customers. Competition is regarded as advantageous for consumers and is seen as essential to ensure consumer benefits of market exchanges (Redmond, 2013). Additionally, markets driven by competition are subject to more efficient resource allocation than markets controlled by government regulation or dominating firms (Redmond, 2013).

The ideal state of competitiveness in a market is often referred to as perfect competition (Redmond, 2013). In the case of perfect competition, there is a high number of sellers, but none are large enough to influence the price on the market. In contrast, there are other market structures where the number of sellers is limited. For

instance, monopoly represents a market where a single firm dominates and controls pricing, which often causes inefficiencies and limits choices for the buyers (Ozeranska, 2021). In addition, oligopoly is a market structure where few firms dominate the market and each firm has enough market power to influence the prices themselves (Negishi, 2014). Moreover, independent firms can come together to collaborate and coordinate their actions, which is typically done to reduce competition and increase profits through attempts to control prices by acting as a monopoly while being multiple firms instead of one (von Auer & Pham, 2021).

Regarding commodity markets, goods are undifferentiated, interchangeable and more or less homogeneous, making competition take on a unique form compared to other industries. In markets where goods can be differentiated, firms can leverage tools such as product differentiation, branding and customer loyalty, also referred to as monopolistic competition (Redmond, 2013). Since these methods of differentiating an offering do not apply to most commodity markets, a different type of competitive dynamic occurs. In fact, studies suggest that commodity markets often exhibit oligopolistic characteristics or tendencies towards cartelisation (Hu et al., 2020; Newbery, 1984). An oligopolistic market structure occurs when a commodity market has a small number of sellers which control a significant share of the resource in question (Hu et al., 2020). Due to the high degree of control and limited availability of resources, the few existing sellers have a significant influence on commodity prices. The oligopolistic structure can either be characterised by price or quantity competition, where either the price offered or the quantity produced is adjusted in order for the selling firm to gain benefits (Carter & MacLaren, 1997). Cartelisation, on the other hand, can occur for commodities where a large portion of the global supply of the market is controlled by a low number of countries, where the commodity agreements often lead to market cartelisation (Newbery, 1984).

Another key aspect of competition is information, which plays a crucial role in shaping the dynamics of market economies. As the accessibility of information impacts buyers' ability to make the most informed purchase decision, it is essential to reduce the presence of imperfect information in the market (Salop, 1976). Imperfect information refers to when all parties in the market have incomplete information, meaning no one can access the complete set of relevant facts or data. In addition to this, information asymmetries can also occur, which means that only one party, usually the seller, has more or better information than the other party, usually a buyer (Clarkson et al., 2007). This creates an imbalance where the party with more information can potentially exploit the other. In some markets, efforts have been made to mitigate the impacts of information asymmetries and imperfect information through regulatory and legislative frameworks designed to address competition problems (Redmond, 2013). These frameworks aim to correct various forms of competition issues that can distort market outcomes and harm customers.

2.2.4 Market Integration

Market integration is a central concept in economic theory. It refers to the degree to which markets for a particular good or service become interconnected over time,

particularly in terms of price movements (Jena, 2016). As previously described, the law of one price assumes that in a spatially integrated market, price discrepancies between geographically separated markets for the same commodity should be minimal, with remaining differences can be attributed to transportation costs (Jena, 2016). Arbitrage plays a crucial role in enforcing the law of one price. In an integrated market, arbitrage ensures that prices converge across regions, keeping price disparities within the bounds of transportation costs and other trade frictions (Goodwin et al., 2021). However, in reality, it is complex to achieve perfect market integration as it depends on various factors such as transaction costs, including tariffs, institutional barriers and imperfect competition, which often distort price transmission and prevent markets from fully integrating (Donaldson, 2015; Goodwin & Piggott, 2001; Jena, 2016).

Commodity market integration, a subset of spatial integration, focuses on the relationships between markets for identical goods across different regions or countries. In a well-integrated commodity market, price changes in one area should quickly be reflected in another region, with only transportation costs causing deviations (Jena, 2016). However, factors such as exchange rate fluctuations and political instability can disrupt this process, leading to market segmentation where prices are not aligned across markets. An important aspect of commodity market integration is the process of price transmission. This refers to how price changes in one market, whether due to changes in supply or demand, are passed on to another market. Price transmission can be asymmetric, meaning that prices may adjust more rapidly when they increase than when they decrease, or vice versa (Jena, 2016). Such asymmetries are often due to market power, where larger actors in the supply chain can influence price movements, or due to high transaction costs that delay the transmission of price changes. Studies have shown that asymmetric price transmission can have significant welfare implications, leading to unequal benefits for producers and consumers, and reinforcing market inefficiencies (Wlazlowski, 2003).

In addition to spatial commodity market integration, vertical integration is also a key concept in market analysis. Vertical integration refers to the linkages between different stages of the supply chain, such as the movement of goods from producers to wholesalers to retailers (Goodwin et al., 2021). In a well-integrated vertical market, price changes at one stage are efficiently passed along to subsequent stages, allowing for smoother adjustments in response to market shocks. However, in practice, various inefficiencies and market power at different stages of the supply chain can prevent this seamless price transmission, resulting in unequal market conditions (Jena, 2016). Market power, for example, can lead to certain actors, such as large wholesalers or retailers, influencing prices and thus distorting the natural flow of price changes through the supply chain. Additionally, horizontal integration or cross-commodity integration can occur, referring to integration between two different commodities (Andrikopoulos & Stoforos, 2023; Jena, 2016).

On the contrary, lack of integration is referred to as market segmentation, which occurs when there are significant price differences for the same goods across different regions or stages in the supply chain, violating the law of one price (Jena,

2016). In spatially segmented markets, these price differences can emerge due to limited price transmission, where market conditions in one location do not influence prices in another region. This often results from barriers such as high transaction costs, inadequate infrastructure, or local market power, all of which prevent price adjustments from occurring across markets (Jena, 2016). Similarly, segmentation can occur vertically within the supply chain, where prices diverge at different stages, such as between wholesale and retail markets. Market segmentation can therefore have significant implications for the functioning of commodity markets, leading to limited competition and inefficient price formation (Jena, 2016). Additionally, segmentation can limit the extent to which price changes in one market are transmitted to others, undermining the goal of market integration and hindering trade effectiveness (Goodwin & Piggott, 2001).

2.2.5 Regulations

To ensure markets function properly, regulations serve as a tool to promote economic growth and development across various market types (OECD, 2011). By utilising regulatory policy, the conditions for various actors such as consumers, businesses, and governments can be dictated in order to protect public rights and safety while also ensuring access to essential goods and services. On the contrary, some argue that the need for regulatory policy is a result of market failure due to imperfect competition and imperfect information (Redmond, 2013). In the case of perfect competition, it is considered that resource allocations would take place more efficiently without the presence of governmental interventions. However, as various actors attempt to influence market conditions to their advantage, governmental institutions often consider regulations as necessary to facilitate market conditions and power distribution (OECD, 2011).

In commodity markets, raw materials are upstream in the supply chain and therefore, raw material prices might be affected by economic mechanisms downstream in the supply chain (Kowalski & Legendre, 2023). For instance, bullwhip effects can occur where small customer demand changes cause significant disruptions in the supply chain. In addition, some commodity markets are characterised by high prices and volatile volumes, also implying the need for governmental intervention (Kowalski & Legendre, 2023). Further, in some countries, natural resources are typically publicly owned, but extraction rights are often offered to private companies, leading to environmental and social impacts that require regulation (Kowalski & Legendre, 2023). The extraction of raw materials in developing nations tends to involve a higher risk of negative consequences, especially related to environmental aspects, as these countries often have legal complexity inherited from various political regimes and colonial powers, resulting in regulations based on a mix of different legal principles (OECD, 2011).

There are mainly three key areas that regulations are typically linked to, either economic, social or environmental issues (Bartle & Vass, 2007; Kowalski & Legendre, 2023; OECD, 2011). Economic regulations are primarily concerned with

shaping market behaviour to ensure efficiency, fairness, and stability in the economy (OECD, 2011). These regulations often address issues like competition, pricing, and market access, aiming to prevent monopolies, promote innovation, and ensure businesses operate within a fair and transparent framework. On the other hand, social regulations focus on safeguarding public interests, such as providing workers' rights, protecting public health and safety, and promoting social equity (OECD, 2011). These regulations are often designed to address societal disparities, protect vulnerable populations, and ensure that individuals can access basic services. Environmental regulations aim to protect natural resources, manage waste, and reduce environmental harm caused by industrial or commercial activities (OECD, 2011). These regulations help ensure the sustainable use of resources, minimise pollution, and address the broader challenges of climate change and biodiversity loss, often requiring industries to adopt more sustainable practices and technologies.

However, lobbying plays a significant role in shaping regulatory policies where powerful interest groups often push for policies that benefit them, sometimes at the expense of the public good (OECD, 2011). This is known as regulatory capture, where regulators end up favouring specific industries because those industries reap the most benefits, while the costs are spread across society (Peltzman, 1976; Stigler, 1971). Some argue that this leads to poor outcomes for society, as interest groups fight for policies that benefit them at the cost of fairness and efficiency (Newbery, 1999). On top of this, political capture can occur, where government officials manipulate regulations for personal or political gain, further distorting the regulatory process (Laffont & Tirole, 1991). In developing countries, these issues are often worse due to weaker institutions, making it easier for the regulatory system to be influenced by powerful groups and less focused on the public good.

3
Methodology

In this chapter, the thesis methodology will be presented. It starts with introducing the research design and the data collection processes of the thesis. Further, the method used for the data analysis is presented, followed by a discussion on how research quality and ethics have been achieved, as well as limitations.

3.1 Research Design

Research strategy is referred to by Bell et al. (2022) as the overall approach chosen for a research project. Research design, research questions, and the method used to answer these questions are all included in the research strategy. Research strategies can be divided into two main categories, qualitative and quantitative. This thesis is based on a qualitative response. As Bell et al. (2022) describe, qualitative research emphasises words over numbers when collecting and analysing data. In addition, qualitative and quantitative research can be differentiated by the methods used to gather data. Quantitative data is collected through statistics, and qualitative research is collected through verbal methods, according to Gustavsson and Säfsten (2019). The research design serves as the framework for collecting and analysing data in business research (Bell et al., 2022). It is closely connected to the research strategy, as it defines the methods available for data collection and supports formulating the research questions that the thesis addresses. Bell et al. (2022) list five research designs: experimental, cross-sectional, longitudinal, case study, and comparative.

The research design of this thesis was a case study. A case study is suitable when researching a specific phenomenon which has a complex nature, according to Bell et al. (2022). A case can be limited to a single organisation or location. This case study was of the type of "representative case" as described by Bell et al. (2022). However, as this study aims to answer what affects the price of wood packaging, it required gathering data outside the organisation to create an understanding of the key factors and underlying mechanisms that affect the price of wood packaging. This study included reviewing documents such as market and industry reports and interviewing experts with insights about the wood market. This thesis was conducted in collaboration with a company that facilitated the gathering of data, making it more easily accessible. Bell et al. (2022) discuss whether a case study can achieve generalisability and good quality criteria, such as validity, reliability, and replicability. However, they conclude that the goal of a case study is to investigate

the case's uniqueness and to understand its complexity, which can be done efficiently using this research design.

Abduction in research methodology often starts with a puzzle or a phenomenon which is not explained by the existing theory of the topic (Bell et al., 2022). Further, Bell et al. (2022) write that to simplify the puzzle, abductive reasoning seeks to identify factors that would cause this, turning the puzzle into something meaningful. This involves a back-and-forth interaction between empirical data and the frame of reference to create an understandable explanation. A drawback is that this requires the researcher to find the "best" explanations or interpretations of the data. This, in turn, depends on the researchers' ability and their preconceptions about the data. Therefore, the researchers need to remain open to the possibility that the data may come with a surprise and not only use it to confirm the researcher's already existing beliefs (Bell et al., 2022). Abductive reasoning was suitable for this thesis, since it evolved from an increase in Swedish wood prices. Additionally, since this phenomenon has occurred relatively recently, there could be different interpretations of its underlying cause.

3.2 Data Collection

Three methods were applied to collect the data necessary to achieve the thesis's aim and address the research questions. A literature study was conducted to establish a frame of reference of existing knowledge regarding factors influencing the commodity market. Interviews were conducted to gather information about the practical use of wood packaging within the case company, to understand the key factors and their underlying mechanisms affecting the price of wood packaging, and an analysis of primary and secondary sources in the form of documentary data was conducted to understand the market. Subsequent sections will present the reasoning behind the choice of these specific methods and how they were accomplished.

3.2.1 Literature Review

According to Snyder (2019), the literature review is important because it relates the empirical data in the report to the existing body of knowledge within the scientific field. Gustavsson and Säfsten (2019) agree and elaborate on the importance of the researcher's understanding of the existing knowledge to contribute to the topic. Therefore, it was important to provide a sufficient overview of the existing knowledge in the field that could serve as a point of departure for the study.

The literature review was conducted to establish the characteristics of the wood market regarding supply and demand, macroeconomic conditions, competition, market integration and regulation. The review was conducted throughout the entire thesis to cover new topics identified during the research. This iterative process was applied due to the abductive research approach this thesis used. However, the literature review was primarily conducted at the beginning of the study. Gustavsson and Säfsten (2019) argue that conducting a literature review should follow a structured

process. Therefore, it is important to design an approach with specific activities and document the results during execution. The following paragraph will discuss what actions have been taken to create such a structured process.

First, an aim was defined to facilitate and serve as the basis for the literature review. The aim of the literature review was formulated to "establish a conceptual understanding of market factors, pricing parameters, and how these relate to commodities in general". Subsequently, suitable keywords were identified that would help accomplish the aim of the literature review. Initially, the search terms were more general to create a broad overview of the different topics investigated and to acquire knowledge that would enable the use of more specific search terms. The terms initially used were "Timber", "Wood", "Roundwood", "Market", and "Industry" in various combinations to create a comprehensive picture of the topic. Thereafter, as more knowledge of the subject was obtained and accumulated, the search terms became more specific. The search word used, in various combinations, in this iteration was "Commodities", "Supply and Demand", "Interest rates", "Exchanges rates", "Inflation", "Economic Cycles", "Competition", "Monopoly", "Information asymmetry", "Regulations" and "Policy".

Thereafter, the databases Google Scholar and Scopus were selected to ensure that a thorough search could be completed. Google Scholar was primarily used to gain an initial understanding of the topic, while Scopus was utilised to gather peer-reviewed sources that could be incorporated into the thesis. Scopus AI was also used as a tool to gather and find foundational documents on specific topics. Using these databases yielded a large number of search results, necessitating the application of filters to the search based on the year of publication and the number of citations each paper had. A snowballing citation was used to retrieve additional suitable sources from certain particularly suitable and related articles. According to Choong et al. (2014), snowballing is the method used when researchers recursively search for references to add to their collection of sources. It has the advantage of not requiring specific search terms, which can vary and be inconsistent. Snowballing reduces the time needed to review the literature and identifies new relevant sources.

3.2.2 Documentary Data

Since this thesis aimed to improve the understanding of key factors that can impact the prices of wood packaging on the Swedish market, documentary data were collected and analysed to gather market insights. According to Bell et al. (2022), documentary data is frequently used in qualitative research and includes a number of different sources, such as personal documents, public documents, organisational documents and media outputs. By utilising various types of data, a broad analysis of market factors was conducted to cover different areas of the Swedish wood market. In addition, documentary data has also been gathered to map the current use of wood packaging in the case company's logistics flow.

The documentary data collection primarily included various industry reports, market studies and insights from governmental and trade organisations. Based on the

key factors identified, other documentary sources have been utilised to provide more detailed information based on the characteristics of each factor. The collected data provided insights into the factors influencing wood packaging market prices and how these factors influence the pricing of sawn timber and roundwood. However, only documents from recognised trade associations, government agencies and organisations' official websites were included to ensure credibility. Further, organisational documents within the case company were gathered to map the current use of wood packaging in the company's logistics flow, providing an internal perspective on the use of wood packaging and its impacts on the organisation. By combining external market data and internal company documentation, this thesis aimed to provide a broad view of the factors influencing wood packaging prices in Sweden.

3.2.3 Interviews

To understand how the flow of wood packaging is structured within the case company, interviews were conducted with employees in relevant positions from the case company. The choice of using interviews as a method was based on several reasons. According to Gustavsson and Säfsten (2019), interviews are suitable for gathering primary information about a distinct phenomenon from various sources. In addition, interviews have the advantage of enabling the researcher to maintain a specific focus, they can give a breadth of coverage regarding what sources can be used and are less prone to reactive effects, according to Bell et al. (2022).

More specifically, semi-structured interviews were deemed the most suitable approach. Leavy (2020) argues that semi-structured interviews are an effective approach to maximise the potential knowledge retrieved through the interviews. Additionally, it allowed the interviewees to clarify misunderstandings. In semi-structured interviews, the interviewer has the freedom to adapt the questions and phrasing depending on the responses from the interviewee (Bell et al., 2022). Moreover, semi-structured interviews are not as limited as structured interviews in terms of the knowledge possessed by the interviewer, which enables a deeper investigation of the subject. These arguments, especially the last one, aligned well with the context of this thesis and the researchers' limited prior knowledge. However, to achieve high reliability, the questions from the interview guide were asked in a similar order and with similar wording.

The first stage of the interview process involved creating drafts of interview guides that incorporated factors derived from the aim, research questions, and frame of reference. This was done to create an agenda for the interviewees and increase the probability that the data gathered would help answer the research questions (Bell et al., 2022). To create an interview guide that achieves high validity, it was important to create drafts and be able to test them, according to Gustavsson and Säfsten (2019). It is also important to develop an interview guide with natural transitions between the themes during the interview. An iterative approach was employed to create questions that would produce in-depth responses from the respondents. This involved conducting initial interviews with individuals at the case company to gather knowledge in order to create an interview guide for the actual interview. The initial

interviews with case company employees are presented in Table 3.1. These interviews helped gather preliminary insights and allowed for the fine-tuning of subsequent questions. Further, the questions were evaluated after each interview based on the respondent's answers. This iterative evaluation refined the interview guides, making the questions more relevant and focused as more interviews were conducted. The main themes in the interview guides remained consistent. However, subtle adjustments were made to the interview guide, as the emphasis on certain themes varied depending on the respondent's role and expertise. Before each interview, the interviewee received a copy of the interview guide to allow time for preparation with accurate and relevant answers. A question about whether the interviewee allowed the interviewer to record the interview was also included in the invitation for the interview.

Table 3.1: *Initial introduction interviews with employees on the case company*

Int.	Role	Mode	Date	Time
1	Senior Buyer & Segment Leader	In-person	2025-01-23	55 min
2	Supplier Manager Packaging	In-person	2025-01-23	30 min
3	Distribution Planner	In-person	2025-01-23	30 min
4	Senior Commodity Buyer	Online	2025-01-23	45 min
5	Raw Material Specialist	Online	2025-02-02	55 min

The second stage of the interview process involved conducting the interviews. The interviews were conducted over three periods, each focusing on a specific aspect of the thesis. First, an initial session was held to discuss the case company and its operations, followed by a period of more in-depth interviews regarding the logistics flow. Thereafter, interviews were conducted to investigate the market factors of the Swedish wood industry. Gustavsson and Säfsten (2019) claim that when conducting interviews, it is important to consider where, how, and with whom they will take place and what topics will be discussed. Specific themes and questions can be more challenging to answer in different environments, making respondents more cautious in their responses.

In this thesis, interviews took place both digitally and in person. However, due to the respondents being located in different parts of the world, most were conducted digitally using the digital software platform Microsoft Teams. It was effective to use digital interviews both in terms of time and cost. Since Microsoft Teams is the preferred platform used at the case company, it was suitable to use it for the digital interview as the interviewees felt more comfortable in such an arrangement. Additionally, digital interviews also have the advantage of built-in transcription software, ensuring no data is lost. However, recording interviews can make respondents hesitant in their responses about what data they want to share. Nevertheless, the advantages were considered greater than the disadvantages. Two researchers collaborated on conducting the interviews, with one responsible for asking questions and the other one for taking notes. The interviews that were conducted at the case company to gather data about the wood packaging flow can be seen in Table 3.2, where

the interview guide presented in Appendix 1 was utilised. The sampling process for respondents working at the case company was completed by initially contacting individuals who held roles related to the thesis topics. This meant that people working with wood packaging and those working with commodities were contacted. Subsequently, the respondents were asked if they knew someone who could be valuable for the study. Additionally, when respondents were unable to answer questions, they were asked to recommend someone who could provide the answers. This created a snowball approach to sampling, allowing us to find the right individuals.

Table 3.2: *Interviews with employees at the case company for outlining the wood packaging flow*

Int.	Role	Mode	Date	Time
1	Senior Buyer & Segment Leader	Online	2025-03-04	55 min
2	Supplier Manager Packaging	In-person	2025-03-05	50 min
3	Project Manager	In-person	2025-03-05	50 min
4	Strategic Packaging Planner	Online	2025-03-10	60 min
5	Senior Commodity Buyer	Online	2025-03-12	60 min

Industry experts were interviewed to acquire primary data about the wood market. Initially, the sampling of interviewees consisted of employees working at a public authority, thereafter, a snowballing approach to sampling was used to find suitable individuals. Following an interview with a Policy Analyst at the public authority, a Senior Advisor from a trade association was interviewed, as were an Associate Professor and a Researcher from two different educational institutions. Lastly, an interview was conducted with the Sales Manager of the wood packaging supplier in the case company. The people interviewed during this session can be found in Table 3.3, and the questions for these interviews were based on the interview guide found in Appendix 2.

Table 3.3: *Interviews for market factors of the Swedish wood market*

Int.	Role	Organisation	Mode	Date	Time
1	Policy Analyst	Public Authority	Online	2025-03-19	55 min
2	Senior Advisor	Trade Association	Online	2025-03-20	70 min
3	Associate Professor	Educational Institute	Online	2025-03-25	40 min
4	Researcher	Educational Institute	Online	2025-03-26	60 min
5	Sales Manager	Wood Packaging Supplier	In-person	2025-03-28	50 min

Bell et al. (2022) emphasise that snowball sampling is not random, and it is important that the researchers evaluate the feasibility of the respondents' recommendations. Using the respondents found through the snowballing method was deemed feasible as they represent a broad variety of stakeholders and perspectives. The possibility that interviewees may have had different perspectives and biases depending on their organisation and role was considered. This also affected who was contacted during this interview period, as it was favourable to have an even distribution of people working close to the forest owners and sawmills. In summary, the combination

of semi-structured interviews, an iterative interview guide approach, and a diverse respondent selection approach has been used to gather information that fulfils the aim and answers both research questions.

3.3 Data Analysis

The utilisation of three different data sources created the possibility to triangulate the data. This increases the trustworthiness of the findings in the thesis. Due to its qualitative characteristics, this study applied thematic analysis to explore the collected data. According to Braun and Clarke (2006), thematic analysis is a valuable method for recognising and interpreting patterns within qualitative data. It offers a structured and adaptable approach. One key strength is that thematic analysis allows flexibility, making it applicable in various contexts without requiring extensive theoretical or technical expertise. This makes it particularly suitable for studies aiming to explore different perspectives and underlying meanings in depth.

The data for this study were primarily gathered through a literature review, semi-structured interviews, and documentary data sources, including industry reports, government reports, and documents from the case company. All interviews were recorded and transcribed shortly after they took place to ensure accuracy. The transcripts were then carefully reviewed, and key themes from the frame of reference were identified, along with unexpected findings that emerged during the interviews, following an abductive approach. Recurring patterns and important insights were grouped into broader themes, forming the basis for deeper analysis. Based on the overarching key factors identified within the frame of reference, different themes were categorised accordingly. These themes were what later became the underlying mechanisms described and discussed in the analysis and discussion. By employing thematic analysis, this study ensures that the findings are closely connected to the data, providing a clear and structured interpretation of participants' perspectives. A similar approach was used to analyse documentary data. Initially, a broad range of sources was considered, and subsequently, these sources were systematically reviewed to identify relevant themes.

3.4 Research Quality

The value provided by research to society is directly tied to its quality, making it essential to address key quality aspects throughout the research process. Bell et al. (2022) presents reliability, replicability and validity as three key criteria to ensure the quality of a thesis. This section discusses these elements in detail, alongside considerations of research ethics.

3.4.1 Reliability

The reliability relates to the extent to which the findings of a study can be reproduced (Bell et al., 2022). This means that applying the same research methodology

and research process should also generate the same results if the conditions remain the same. In order to ensure the reliability of the study, each market factor identified has been covered with knowledge by at least two of the interviewees. This has been done to minimise the potential impact of personal opinions and biases, a method supported by Patel and Davidsson (2019). In addition, all interviews were conducted using an interview guide that was developed to standardise the structure of the interviews, while still maintaining a semi-structured approach to allow for exploring new insights.

3.4.2 Replicability

According to Bell et al. (2022), replicability is closely related to reliability, as it refers to the ability of other researchers to reproduce the study's findings by following the same methodology. To ensure replicability in this study, all aspects of the research process have been carefully documented and standardised. This includes the use of a semi-structured interview guide, which provides consistency across interviews while still allowing the flexibility to explore new ideas as they arise. Detailed descriptions of participant selection, data collection, and analysis methods are included to ensure that other researchers can follow the same procedures. By providing this level of transparency and clarity in the methodology, the study aims to ensure that its findings can be replicated in future research.

3.4.3 Validity

Validity might be the most important criteria and is explained by Bell et al. (2022) as ensuring that the conclusions drawn from research are well-founded and reflect the actual phenomena being studied. To achieve this, a comprehensive approach has been employed. First, a literature review has been conducted by utilising multiple sources to ensure that the research is grounded in existing knowledge. Second, a framework supported by mostly academic literature but also empirical data has been developed to provide a structured and validated method for assessing the study's main themes. Finally, all interviewees have been anonymised to encourage honest and truthful responses and improve the accuracy of the data collected. This increases the probability that the study measures what it is intended to measure. These measures have collectively contributed to the overall validity of the research findings.

3.4.4 Research Ethics

Research ethics are essential to ensure the integrity and credibility of the study while also respecting the rights of participants (Bell et al., 2022). Ethical principles guide researchers in conducting their work with a responsible and transparent approach, ensuring that all aspects of the research process uphold fairness and accountability, with respect for all individuals involved. As Bryman et al. (2021) highlights, ethical considerations are not just procedural requirements but are fundamental to producing trustworthy research that respects participants and minimises potential harm.

To uphold these principles, this study implemented several key measures. First, participants were fully informed about the purpose of the research, how their data would be used, and their right to withdraw at any time. This aligns with the principle of informed consent, as emphasised by Patel and Davidsson (2019), ensuring that participants have engaged with full knowledge of the process. Secondly, confidentiality and anonymity were strictly maintained by anonymising all interview data. These steps encouraged participants to provide candid responses while creating a foundation for reliable and meaningful data.

3.4.5 Limitations of the Methodology

This section presents the limitations of the methodology for this thesis and outlines the actions taken to mitigate them. As mentioned before, every research project is dependent on its scope. This scope can be restricted or limited by factors such as time, resources, the availability of data sources, and the researchers' knowledge. This is the case for this research, nonetheless.

During the research, interviews have been conducted with people who are knowledgeable in the wood market and especially the sawn timber market. However, the insights and arguments from these respondents will always be influenced by their previous experiences, roles, and current occupations. The fact that it is not possible for respondents to provide a complete picture and remain completely unbiased has been considered. One way to mitigate the risk of having biased data in a thesis is to consider the distribution of the respondents carefully. The interviewees represent different parts of the value chain. This has been considered to create a balance between stakeholders with opposing views or opinions regarding specific questions. The role that the respondents hold in their organisations has also been considered to identify individuals who can provide answers related to the research questions, at the appropriate level of detail and expertise. This resulted in most of the interviewees working with analysing the wood market as a researcher or as a market analyst at a company. Although respondents cannot provide a complete and comprehensive picture in a one-hour interview, they were selected to offer different perspectives that, collectively, contribute to a holistic understanding of the situation in the wood market. The various perceptions held by the interviewees can perhaps provide even more nuance, as they are analysed simultaneously and contrasted with each other.

The parameters identified as key factors affecting the price of wood packaging were determined during the initial literature review. These factors were the themes that occurred most frequently and also had a significant impact on the price of other commodities. This method could have led the research to the wrong key factors. Therefore, at the end of the interview, the respondent was given the opportunity to add factors that they deemed vital for the price change of wood in Sweden. The responses to these questions were mostly that they did not have any additional factors or perspectives on the already discussed topic. This may indicate that the chosen factors provide a comprehensive picture of the current market situation.

4
Empirical data

This section offers an introduction to the case company by providing an overview of the wood packaging process in terms of flow and packaging management, as well as addressing which markets the wood packaging is mainly sourced from. Further, the Swedish wood market is outlined in terms of market structure, value chain, supply of wood, demand of wood, macroeconomics, and regulatory policies. This chapter is based on data from the interviews unless otherwise is stated.

4.1 Introduction of the Case Company

The case company is a market-leading international manufacturing company with its headquarters in Europe, offering high-end solutions within the mobility sector. It is a major player in development and production within various industries. The company operates in most countries worldwide and has a significant presence across Europe, Asia, and the Americas. As in most industries, the company's sector has rapidly changed due to environmental regulations, technological development and increased demand for sustainable operations. The company employs tens of thousands of people globally and operates with a decentralised structure, comprising regional business units and manufacturing facilities. Its service centres are spread across multiple continents, providing a global network. This enables the company to offer comprehensive aftermarket services, including maintenance, spare parts, and repairs, which contribute a significant portion of its revenue. The core business model is built on selling their products directly to businesses. However, value-adding services and digital solutions have become increasingly important for maintaining the position as a market leader and meeting new customer needs.

An effective and sustainable logistics flow is essential for maintaining a competitive edge for the case company, and therefore, the operations related to the flow are closely followed. With operations spanning Europe, Asia, and North America, the company faces complex logistical challenges that extend across multiple regions and product lines. The efficient movement of materials and finished goods is crucial for minimising lead times and reducing costs. In particular, wood packaging plays a key role in enabling production, transport and storage on a global level. Securing cost-effective wood packaging solutions is critical to the company, as fluctuations in raw material prices can directly impact operational costs. The following subchapter will map and describe the current logistics flow of the case company, including operational use and the sourcing process of the wood packaging.

4.1.1 Wood Packaging Flows

Globally, the case company has a large number of suppliers, spare parts distribution centres, and manufacturing facilities that need to be coordinated in operational terms. Therefore, the company's logistics department has gradually developed different forms of packaging flows, which can be categorised into three types. The three types of flows are standardised flow, specialised flow and single-use flow, each involving the use of wood packaging. These different flows consist of packed goods, where packaging in various materials is used. In the operations of the case company, wood, plastic, cardboard, and metal are commonly used, with each material having its benefits and drawbacks. Thus, it has different areas of application depending on the different operational needs. However, the following paragraphs will focus more specifically on how wood packaging solutions are managed in these flows.

Firstly, the standardised flow, illustrated in Figure 4.1, is a reusable and returnable modular packaging system used for most deliveries within the case company. In the standardised flow, the wooden packaging consists of three components, a pallet, collars and a lid. These components are a part of the modular system, which allows flexibility in adjusting the packaging depending on the parts or goods being transported. The wood packaging is mainly sourced from Swedish suppliers, where the primary materials used are spruce and pine. Although the packaging has several different designs and sizes, these are designed to follow standardised dimensions, allowing for a high load factor for various carriers. The standardised flow continuously passes through different operational sites, including external users, such as first- and second-tier suppliers, and internal users, such as manufacturing facilities and distribution centres. Due to the high number of stakeholders in the flow, achieving a high degree of standardisation is important to make it applicable. To ensure continuous flow, there is a need to rebalance the levels between the regions and between the different sites. This is managed by transporting empty packaging around to replenish the stock of sites with high demand. The transportation of empty packaging can be done efficiently as they are designed to be foldable or stackable to minimise space use when empty.

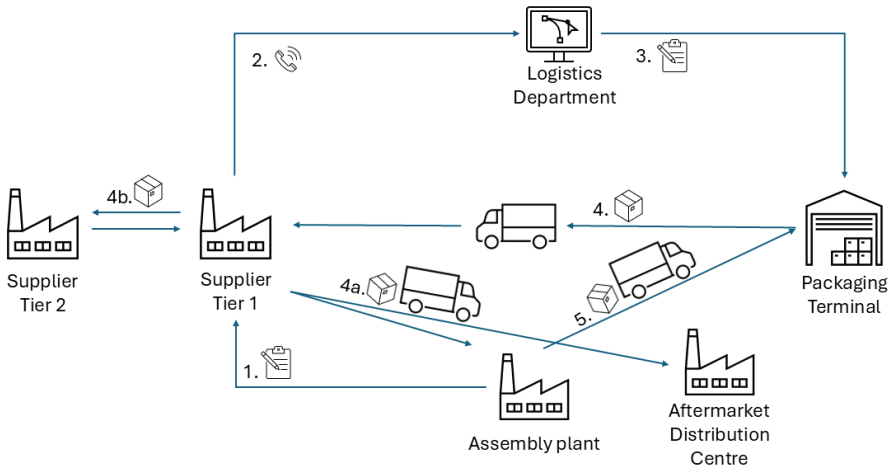

Figure 4.1: Illustration of the standardised flow

Standardised flow:

1. The assembly plant requests a part from a supplier.
2. The supplier then contacts the Logistics Department.
3. The Logistics Department sends a request to a packaging terminal and carrier.
4. A carrier transports empty packaging that can go by either path (a) or (b):
   (a) The packaging goes to a first-tier supplier. After loading, there is an inbound transport between the supplier and the assembly plant or an aftermarket distribution centre.
   (b) The packaging goes to a second-tier supplier. The packaging can return to the first-tier supplier or further upstream in the supply chain.
5. The empty packaging is thereafter delivered back to the packaging terminal to close the loop.

Secondly, some parts need a specialised solution as they do not fit the dimensions of the standardised packaging or have other requirements, this can be the case for large parts, fragile goods, or bulky goods. Therefore, the packaging solutions for these parts need to be developed closely in collaboration with the users, creating a specialised flow. The specialised flow is often organised as a closed loop between two specific users, usually one supplier and one manufacturing site, where packaging is transported back and forth between these two locations. An example of a specialised flow is illustrated in Figure 4.2. In addition, a beneficial characteristic of this flow is that the case company can monitor the location of the specific packaging unit in the system. However, as such specialised solutions can be both costly and time-consuming to develop, especially when the number of users are limited, they are avoided as long as they do not affect the quality of the parts or goods transported. Due to this, only a minority of the total global logistics flows of the case company consists of specialised flow.

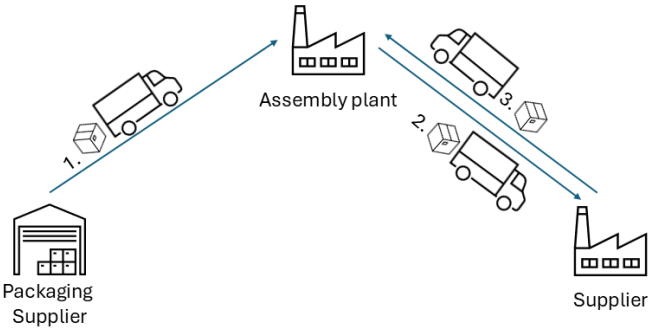

Figure 4.2: Illustration of the specialised flow

Specialised flow:

1. The packaging is delivered by a packaging supplier to an assembly plant.
2. The packaging is then delivered to a supplier.
3. Parts are then loaded using the packaging and returned to the assembly plant.
4. Step 2-3 is repeated until the packaging is depleted.

Thirdly, the single-use flow consists of commercial and other one-time use packaging. These are mostly used for spare parts, with the aim of transporting the parts from

one location to another without the need for return. Therefore, it is most common for central distribution centres to be the outbounds for this flow. A typical single-use flow is illustrated in Figure 4.3. One of the main wood packaging solutions used in the single-use flow is crates, where a wooden structure is built for the specific parts or goods based on given requirements. Due to the critical time aspect, the packaging solutions in the single-use flow are typically sourced locally, close to the distribution centres.

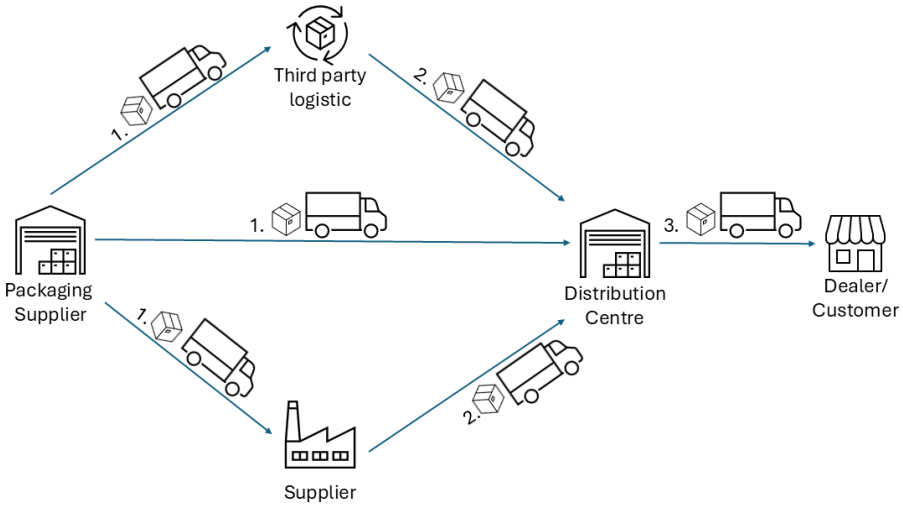

Figure 4.3: Illustration of the single-use flow

Single-use flow:

1. The packaging supplier sends the packaging to a supplier, a third-party logistics provider, or the distribution centre.
2. The packaging is then sent to the distribution centre from the supplier or the third-party logistics provider after being loaded.
3. Parts are then transported from the distribution centre to a customer or a dealer.

4.1.2 Wood Packaging Management

When the wood packaging requires repair or cleaning, users are constrained to report this so that the packaging can be sent to a terminal, such as the packaging terminal illustrated in Figure 4.1, that cleans or repairs it. A benefit of using packaging made out of wood is that it increases the possibility of reusing packaging components and, in turn, increases the lifetime of the material. The estimated lifespan of standardised packaging made out of wood is on average seven years. When repairing the packaging is no longer possible, they are disposed of, either by recycling or as energy.

The case company utilises a software system to manage the workflow. Both first and second-tier suppliers have access to this system. However, the first-tier supplier can use Electronic Data Interchange (EDI) to automatically update location and status changes of the packaging. As previously mentioned, the suppliers are required to report if the packaging needs service or goes missing. To discourage suppliers from

overstocking packaging from the case company, a fee is applied if the packaging is stored for more than 21 days within a supplier's facility. The case company's factories cover the cost of using the packaging for first-tier suppliers, while second-tier suppliers must cover the cost of the tear on the packaging.

The amount of disposed and missing packaging, together with the production rate, are two of the primary measures used when forecasting the future demand of wood packaging. However, there is a discrepancy between the length of the period for which production needs to be forecast and the time required for purchasing packaging, which can create a difference between the demand and supply of packaging. Additionally, the overstocking of packaging in the case company is a problem that can arise if there are large fluctuations in the production rate. This can entail the need to store excess packaging, which increases cost. However, planners can adjust for minor fluctuations by reducing packaging order volumes for the subsequent periods.

There is a wide range of ways in which wood is utilised within the logistics flows. The most common way is pallets, lids and pallet collars. Additionally, wood is used for boxes, as supports for other packaging and frames. Wood is also used in specialised built constructions for heavier or bulkier goods, as in the specialised or one-time use flow. A drawback of using wood as a material is that the case company has to be able to track the country of origin when the packaging is transported between different countries, which is the case for the standardised flow, due to regulations and customs requirements. It may be possible to source wood from countries other than Sweden for use in the standardised flow. However, this would require additional administrative resources to manage the data, which the current system does not support.

Wood has two main drawbacks compared to other materials, such as plastic and steel. Wood has a shorter lifetime than steel and cannot achieve the same degree of cleanness as plastic or steel. Plastic is instead static and attracts dust, while steel is heavy to handle. However, wood is cheaper than plastic, and plastic boxes lack standardised measures that can cause limitations when sourcing suppliers. Another benefit of using wood as a packaging material is that it is sustainable as it binds CO2, for example, one pallet binds approximately 25 kg of CO2. Wooden materials are lighter than steel, which increases the load factor while also being cheaper considering their durability.

When the case company considers a design change for wood packaging, a large network of experts and packaging technicians is involved to support and advise on its feasibility. Design modifications are often denied due to operational implications since the cost reduction achieved through design changes is typically much smaller than the total cost incurred by other operations. As a result, total ownership costs tend to increase, and the savings from a lower purchase price do not sufficiently compensate for these added costs. However, when a new packaging is to be implemented, the requirements are initially published without specifying a particular material. Then, during the procurement process, different market actors propose

various solutions with other materials, allowing the case company to select the best solutions available on the market. However, finding suppliers that can offer a complete packaging solution can be challenging, which might affect how packaging is developed.

4.2 The Swedish Wood Market

A significant part of the wood packaging purchased by the case company is sourced from Sweden. One of the key reasons is that most of the operations in the case company are performed in Sweden, while Sweden is also a major wood supplier, making it convenient to source from the Swedish market. In addition to this, the standardised flow is a global flow where packaging units are transported between countries, which implies customs requirements. In order to reduce transfer times and ease the administration of the standardised packaging in the system, the packaging used for the standardised flow needs to be sourced from the same country. Therefore, it is important to analyse what dynamics have a major effect on the price of wood packaging produced in Sweden. This, in turn, is highly affected by the price of the raw material that is used in the production, namely sawn timber, which is made of roundwood produced in Sweden. To be able to create resilient price-setting strategies for the case company, it is therefore important to map and summarise the factors that affect the procurement decision. The data gathered regarding the Swedish market have been acquired during the interviews in Table 3.3. Additionally, supplementary information has been gathered from market reports and academic articles. Hereafter, wood will refer to the overall material that can be used in different segments of this industry. In Appendix 3, additional definitions for classification of wood can be found.

4.2.1 Market Structure

Sweden is one of the most forest-rich countries, with nearly 70% of its land area covered by forest (Skogsindustrierna, 2024). This vast natural resource has played an important role historically in the country's economic development and foreign trade. This has created a wood market comprising a diverse range of actors, including thousands of individual stakeholders operating at different levels of the value chain. These stakeholders have different agendas and interests regarding how the forest and its resources should be used. The roundwood produced in the forests is divided into three main assortments, sawlogs, pulpwood, and fuelwood, depending on what part of the tree is used and the quality of the wood. In addition to the various aspects of market structure, including export and import, market integration, and competitive structure, the following paragraphs will describe these elements.

The wood industry is an essential industry in Sweden that directly accounts for 2.2% of the country's GDP (Statistiska centralbyrån, 2024) and 9-12% of the total turnover of the Swedish industry, according to (Skogsindustrierna, 2025). The industry is vital not only in terms of economic output but also in supporting employment and contributing to Sweden's exports. The sector employs over 50,000

people in processing and value-adding activities, such as sawmills and factories and an additional 30,000 in forestry (Skogsstyrelsen, n.d.-d). However, the industry has undergone notable changes in terms of employment. Over the past 20 years, employment in the production of paper and paper products has reduced by 15 000 (Skogsstyrelsen, n.d.-d). In contrast, the number of people employed to produce wooden products increased by 7 000. During the same period, the value of the exported goods from the wood industry, i.e. pulp, sawn timber, paper and cardboard, has nearly doubled.

A large part of the products that are produced in Sweden is exported. According to Skogsindustrierna (2025), 83% of the wood products produced were exported, valued at 184 billion in the Swedish currency (SEK). The largest trade partners are in Europe, which accounts for 54% of exports, including the United Kingdom, the Netherlands, Denmark and Norway (United Nations Comtrade, 2025). However, other major export markets include the US, Egypt and Japan, demonstrating a global demand for Swedish wood products, as seen in Table 4.1. The size of the volume exported to different countries is determined by the prices they offer for the products. For example, Egypt is not a prioritised market, but it receives a larger share of the volume when prices are low and a smaller share when prices are high. The Swedish wood industry does not import significant volumes of wood from other countries. However, smaller volumes are imported from Norway and from Baltic countries, which are mostly used in the pulp industry (Bergman, 2024). Among all product categories, sawn wood represents the largest part of export value. This is because it is much more efficient to export value-added products, such as sawn timber, instead of roundwood.

Table 4.1: *The 10th largest export markets for sawn timber for Sweden in 2024 (United Nations Comtrade, 2025)*

Market	Trade value ($US)	Net weight (kg)	Qty (m^3)
United Kingdom	823 460 969	1 331 715 776	2 725 641
Netherlands	331 680 094	521 628 000	1 090 684
US	303 849 465	490 279 899	1 028 339
Egypt	279 306 231	779 312 000	1 438 328
Japan	257 750 798	417 298 188	812 855
Denmark	244 432 590	424 533 453	829 721
Norway	235 303 397	359 562 836	672 774
Germany	228 809 798	363 438 000	764 226
France	118 046 725	185 253 000	375 717
Poland	111 586 341	202 796 000	427 741

Sawn timber that is not exported is used in various segments of Sweden. The primary uses of sawn timber are in renovation, remodelling, and extension projects referred to in Sweden as ROT (Renovering, Ombyggnad och Tillbyggnad), originating from the tax deduction system in place supporting private individuals undertaking home improvement work (Svenskt Trä, n.d.). The material in this category is mainly distributed through builders' merchants. Further, the second largest segment is new

house constructions, including larger houses and single-family houses, together with cross-laminated timber (CLT). Wooden packaging and pallets are the third-largest segment for sawn timber. These three assortments are using 77% of the sawn timber volume that stays within Sweden.

The distribution of forest owners in Sweden is visualised in Table 4.2. This shows that a large part of the owners do not own large forests. 82% of the owners own less than 50 hectares of forest. However, ownership structures have changed over time. According to the statistics from Skogsstyrelsen (2023a), the number of owners decreased from 354 288 in 2003 to 309 587 in 2023. This decline is accompanied by a trend toward consolidation, with a rising share of owners holding larger forest properties and a reduction in ownership among those with smaller holdings.

Table 4.2: *Number of private owners of the forests in Sweden by size in 2023 (Skogsstyrelsen, n.d.-a)*

Size (ha)	2023
<= 5	108 817
>5-20	87 460
>20-50	58 662
>50-100	30 851
>100-200	15 579
>200-400	5 877
>400-1000	1 934
>1000	407

Approximately half of the productive forest in Sweden is owned by private individuals. The second largest category is the private limited companies, accounting for 25% of the forest area, and the third largest is state-owned limited companies owning 13% of the Swedish forest Skogsstyrelsen (n.d.-a). The productive forest area distribution of the different ownership categories by region is visualised in Table 4.3. In Sweden, there are also several large private limited companies that both own forests and the facilities for value-adding activities. Some examples of this are SCA, Holmen Group and Stora Enso. They have a global presence with pulp and paper factories and sawmills in several different countries. This vertical integration creates a competitive advantage as they can achieve economies of scale and minimise transaction costs between various levels in the supply chain. However, because of the high demand that is not covered by their forest holdings, they buy wood from private owners, each other, and large forest owners. There are also other types of organisations on the wood market, such as Södra and Norra. Both act as forestry industry groups in Sweden, structured as cooperatives owned by thousands of private forest owners. They both have their production sites within the pulp, sawn wood, and energy sectors, as well as an organisation to support the forestry and services connected to the forestry of the members. Additionally, smaller local sawmill companies own a few production sites each. However, these are becoming fewer due to consolidation, and it is difficult to keep them profitable.

Table 4.3: *Distribution of productive forest area (thousands hectare) by region categorised by ownership categories 2023 (Skogsstyrelsen, n.d.-a)*

Ownership category	No. Norrland	So. Norrland	Svealand	Götaland	Total area
Private owners	2 567	2 508	2 545	3 724	11 344 (48,6%)
Private Ltd.	1 145	2 714	1 634	324	5 818 (24,9%)
State owned Ltd.	2 060	256	447	312	3 075 (13,2%)
The Swedish state	786	231	228	80	1 324 (5,7%)
Other private owners	462	162	523	291	1 438 (6,2%)
Other owners	55	63	128	111	357 (1,5%)
Total productive area	7 075	5 934	5 505	4 842	23 356

The Swedish forest is typically divided into four regions, Northern Norrland, Southern Norrland, Svealand and Götaland as seen in Figure 4.4. These regions differ in terms of ownership structure. The largest part of the productive forest area is located in the Northern Norrland with 7.1 million hectares, where state-owned and private limited companies own a large part of the forest. In contrast, Götaland has the smallest productive forest area, accounting for 4.8 million hectares. In this region, the largest ownership category is private individuals, accounting for 77% of the area.

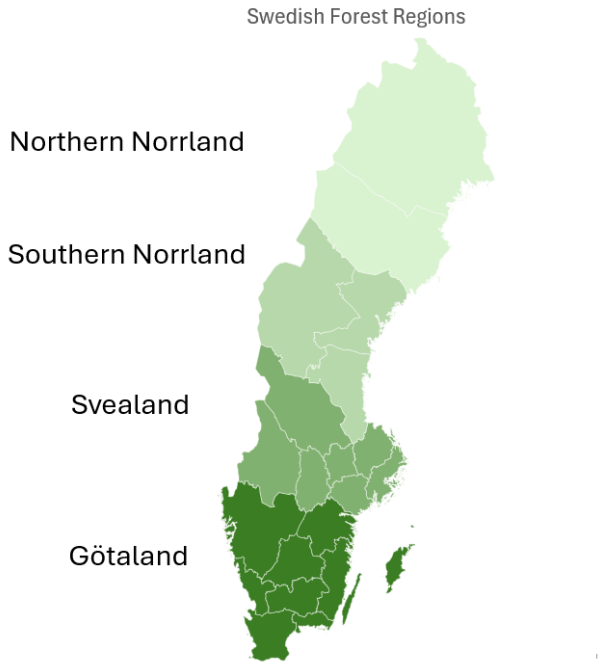

Figure 4.4: Illustration of the forest regions in Sweden

These ownership structures substantially affect the wood market, particularly in terms of price and the supply structure of roundwood. As mentioned, the forest in the south is predominantly owned by small-scale private owners. Whereas in the north, large private limited companies own and manage extensive forest areas. Therefore, a larger share of the northern forest land is used for pulpwood as the large private owners are active in the pulp and paper industry, while the forest lands in

the south tend to have sawlogs as the primary assortment. Such differences affect the efficiency of procuring wood, as geographic location is central in determining the sourcing conditions and the price of the raw materials. A consequence of this is intensified competition for raw materials in southern Sweden. Private small owners actively negotiate prices with sawmills to maximise return. Since different parts of the tree are used in different industries, the procurement is commonly carried out with an intermediary such as Södra.

The price setting in the wood market is complex and can not be attributed to a single actor, and experts have different perspectives on which actors have market power. It can be argued that small-scale forest owners often depend on buyers, who may have an informational advantage, giving them a higher degree of market power. There are also cases where the buyer acts as an advisor and support function, so called forestry industry groups. On the other hand, some experts argue that forest owners have more market power since they can decide when to harvest the forest. Others argue that large private companies have more market power since they control a larger part of the value chain. Sweden has historically had a low roundwood price, however, in the past five years it has risen. This has led to increased competition for roundwood among sawmills, as they have difficulties transferring the price down the value chain. This, in turn, is because the price for sawn timber is not based on cost calculation but on the supply and demand from the market. It is not clear where the market power is located in the Swedish wood industry Bergman (2024) claims in a report to the Swedish Forest Agency.

Except for the regional price variations within Sweden, there are also differences in roundwood prices between countries. The Swedish sawmills have enjoyed a comparative advantage in lower domestic roundwood prices and cheaper energy compared to industries in other countries. Since the majority of the roundwood used in Swedish sawmills is sourced from Sweden, this advantage can be attributed to a low degree of market integration for roundwood internationally, which is primarily due to the high transport costs associated with roundwood. As a result, domestic prices for roundwood have remained low, contributing to the profitability of the paper and pulp industry and sawmills. However, while the input side benefits from the regional prices, the output side of the sawmills operates under price-taking conditions. This results from the high level of global market integration for sawn timber, which increases the competition. During the COVID-19 pandemic, there was a shortage of sawn timber. This resulted in prices across various markets having a high degree of correlation. During this period, Swedish sawmills could negotiate prices as the demand was so high that they could choose their sawn timber buyers.

Although the roundwood market is not that integrated between countries, there is some competition regarding how the raw material will be used. The pulp and paper industry faces increasing competition from the energy sector as the demand for fuelwood has increased among district heating facilities and combined heating and power plants (CHP) due to higher energy prices. This presents a challenge for the pulp and paper industries, as they need to purchase more of the higher-grade materials from the tree, thereby increasing competition for these parts of the tree.

Recently, sawn timber has faced increased competition due to the growing demand for renewable energy sources.

4.2.2 Value Chain

The wood industry value chain contains a series of interconnected actors and processes to transform the raw material into finished products for various markets. It includes forestry, harvesting, transporting, processing into fuelwood, pulp, or sawn timber and then further value-adding activities to turn these materials into final products. Figure 4.5 illustrates a simplified version of the value chain. However, the value chain will be described in more detail in subsequent paragraphs, together with insight about activities from the interviewed experts. The focus will be on the value chain of the material that is used in the production of wood packaging material.

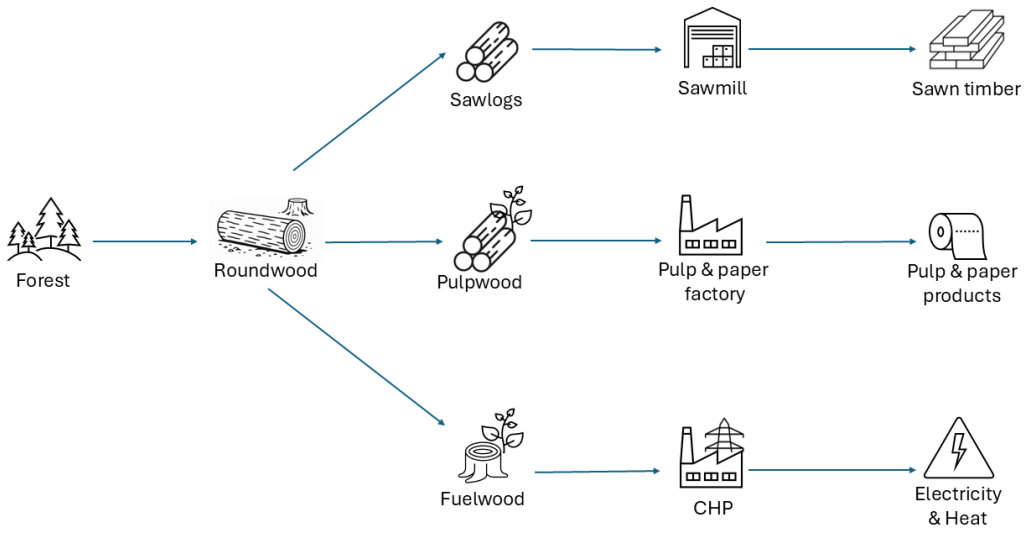

Figure 4.5: Simplified version of the value chain within the wood industry

The initial step in the value chain is forestry operations, including planting, cultivation and harvesting of the forest. This process, from when the tree is planted until the tree is harvested, takes approximately 70 years, depending on the species. The growth cycle of trees is shortening, resulting in a reduced time until harvesting can happen. This increases the yearly production of the Swedish forests. In Sweden, approximately 95 million m^3 of wood are harvested every year. This is a 20 million m^3 increase in the past 20 years. Forest owners have different purposes regarding what their forest assets primarily are used for. There are those private limited companies that own forests for their immediate production, while many private individual forest owners keep these holdings as an insurance. There is a discussion about whether the forest owners are fairly compensated for their raw material. The current market situation has driven the roundwood price up. However, as mentioned before, the price of roundwood in Sweden has historically been low compared to resembling countries. This has caused some forest owners in northern Sweden to export wood to Finland to get paid more. There have also been cases where roundwood has been imported to Sweden from the Baltic countries as a means to apply downward

pressure on domestic prices, specifically on pulpwood. However, a majority of the pulpwood used in production in Sweden is sourced domestically. There is also a perspective that the wood industry is a conservative market and that forest owners could become more profitable if they would request price quotas, ultimately selling to the one offering the highest price. This is rare in practice as owners prefer to hire a forestry company or forest industry group that handles all services from harvesting to sale.

After the trees are harvested, the raw material is sorted into different assortments, such as sawlogs, pulpwood, and fuelwood, depending on their quality and size. Sawlogs are the largest one, accounting for approximately 46% of the raw material produced (Skogsstyrelsen, 2023b). This material is typically purchased by sawmills and processed into wood products such as packaging, sawn timber boards and wooden beams. These products are mainly derived from the bottom part of the tree, where the trunk is the widest. The second largest assortment is pulpwood, which represents approximately 41% of the raw material (Skogsstyrelsen, 2023b). This is supplied to the pulp and paper industry for further processing. The parts of the tree used for pulpwood are typically the outer layers and the middle part of the trunk. The final assortment is fuelwood, which makes up 13% of the raw material (Skogsstyrelsen, 2023b). It is used for district heating, in CHPs and within factories, for example, to dry sawn timber during processing. The economic return for forest owners is determined by the extent to which various tree components can be effectively sold and utilised. The forest owners get the most money from the high-quality logs destined for construction material. Medium-grade roundwood is typically used for paper, pulp, and packaging material, while the lowest-quality wood, such as branches and tree tops, is used for pulp and energy production. These assortments are then transported to their specific processing facilities, where different value-adding processes take place.

Pulpwood is converted to paper, cardboard, and other products at the pulp and paper mills. Fuelwood is typically sent to energy plants to produce bioenergy or district heating. The sawlogs are processed into products such as sawn timber, planks and beams at sawmills. There has been some criticism towards the relatively low value added at sawmills in Sweden. Rather than investing in further refinement of the wood products, the sawmills focus on basic processing and export them as bulk instead. In contrast, wood industry companies in Germany and the UK demonstrate a stronger ability to add value to their products by producing more refined products. This discrepancy can be attributed to sawmills' more conservative approach to innovation. The exception is the production of CLT beams, which is a successful innovative way to add more value to the sawn timber. The different owner structures of sawmills also affect the modes of operation and the degree of innovation. Sawmill owners can be categorised into integrated forest industry groups, large sawmill groups, and small sawmills. The integrated forest industry groups have a unique position of owning their raw material and can therefore utilise the whole tree. These can also be the most innovative in developing their operations and products. At the same time, the other two categories need to purchase roundwood from state-owned companies or private forest owners.

As previously mentioned, producers need to maximise the use of the raw material purchased. This is achieved by identifying customer segments that align with the qualities and characteristics of the various parts of the tree. Regarding wood packaging, certain parts of the tree are more suitable for packaging production. Therefore, most sawmills allocate a specific portion of their wood materials for packaging purposes, which is purchased by industrial manufacturers to produce pallets, lids, and collars. The wood that is not used for packaging undergoes additional processes to add value to the products, ultimately ending up in industries such as construction or furniture manufacturing.

4.2.3 Supply of Wood

The overall wood supply in Sweden and globally is limited, as it is a natural resource. Although wood is considered a renewable resource, the total area of forest currently available for harvesting in Sweden is considered relatively fixed, while the age distribution of the forest is evenly balanced, and the annual growth rate is steady. This implies that the supply of Swedish wood will remain comparatively equal each year, limiting the potential for increasing the supply. Historically, the supply of Swedish wood has exceeded the demand, and therefore, the yearly harvest rates have been lower than the annual forest growth rate. As a result, the total amount of forest stock in Sweden has increased along with the level of carbon stored in the forest.

However, there has recently been a shift in the balance between supply and demand of wood globally, as there has been a significant increase in demand, as further explained in subsection 4.2.4, where the demand now exceeds the supply. In Sweden, this has led to a push for increasing the supply of wood, resulting in a significant increase in the harvest of Swedish forests. The resource utilisation of the Swedish forest is currently exceptionally high, possibly among the highest in the world. Even though the forest growth previously has been greater than what has been harvested, there is a limit to how much roundwood can be harvested, as wood is a limited resource. Additionally, aspects such as biodiversity and carbon sequestration need to be considered when balancing the roundwood extraction to ensure ecological functions and minimise potential harm to the ecosystem. Experts argue that the new harvesting levels might not be regarded as endurable forestry practices, and certainly not as sustainable in a broader sense. On the other hand, some actors in the Swedish wood industry argue that it is feasible to maintain high harvest rates, both from a climate perspective and to facilitate industry growth, as increased harvesting can increase CO2 sequestration.

This sheds light on the fact that there are different interests in how the Swedish forest should be managed and utilised to create the greatest value. Some acknowledge the importance of natural values and maintaining a sustainable ecosystem, while others recognise the importance of providing beneficial conditions for the Swedish wood industry. This issue involves a high number of stakeholders, not only forest owners and industry actors, but also governments and society as a whole. One way of managing the utilisation of Swedish forests and the associated forest management practices is through regulations, which are primarily carried out through

regulatory policies developed by the European Union (EU). However, developing such regulations is complex, as it involves considering a wide range of economic and environmental values that have implications for a large number of actors. For the Swedish wood industry, the availability of raw materials can constrain the volume of wood products entering the market. At the same time, uncertainty regarding future supply might impact the incentives to invest in new sawmills. As there are various regulations related to the Swedish forest and its management practices, these are explained in more detail in subsection 4.2.6.

Moreover, world events such as the Russia-Ukraine war have also contributed to further discrepancy between supply and demand of wood (Jonsson, 2024). The import bans on Russian and Belarusian goods have caused disruptions in the supply chain and resulted in a supply shock for various raw materials. This impacts the global dynamics when it comes to the supply of wood, which also affects the Swedish market. As the total global supply decreases due to the sanctions, the supply of Swedish wood remains relatively constant, while global demand continues to grow, driving prices upward. In addition, Russia is one of the regions where the supply could have been increased before the war, but this is no longer possible due to the bans. As the possibilities for balancing global supply and demand are limited, this is expected to keep wood prices at a higher level.

In recent years, there has also been increased damage to forests due to invasive insects and climate change, not primarily in Sweden, but it might be a potential threat in the future. One of the main regions for global wood supply is British Columbia in Canada, where bark beetles have caused extensive damage to vast forest areas, resulting in significant tree mortality and overharvesting to prevent further damage. This infestation, combined with warmer temperatures due to climate change, has led to a rapid spread of the beetle, which in turn has threatened the wood industry and caused the closing of sawmills across British Columbia. Unfortunately, there have also been major issues related to the spread of bark beetles in Central Europe, which causes damage and limits the possibilities of wood production. If similar patterns were to occur in Sweden, this could pose a serious risk to the Swedish wood supply and the overall forest health. There are also concerns regarding the impact of climate change on Swedish forests, as it might affect the forest growth negatively.

Another important aspect of Swedish wood supply from a more national perspective is demographic changes and trends among the Swedish private forest owners. As the Swedish population is ageing, this causes changes when it comes to managing assets and behaviours related to ownership. In Sweden, private forest owners hold a significant proportion of the country's productive forest area, where the owners have an ageing demographic with a decreasing number of owners no longer residing on their properties (Skogsstyrelsen, n.d.-a). This demographic shift has implications for forest management practices, as the physical distance may decrease the likelihood of active forest management and harvesting. The changing age structure of private forest owners also contributes to a rise in generational transfers of forest properties, where the younger generations tend to lack the same level of interest in managing the forest holding and instead view it as a potential source of extra income (Andersson & Keskitalo, 2019). Additionally, some private forest owners hold their property

as a long-term investment rather than a direct source of income, which might reduce the motivation to engage in regular harvest activities. Some argue that these demographic changes, combined with the new objectives of the forest owners, can lead to higher unpredictability and less stability of the Swedish wood supply, while it might cause a general decrease in the wood supply in the long run.

4.2.4 Demand of Wood

As previously mentioned, there has been a significant increase in demand for wood in recent years, driven by both domestic and global factors. When examining the demand for sawn timber, it is important to recognise that it is a global commodity subject to national and global market conditions. Additionally, Europe has shifted from being an import region to an export region, while Sweden has always been an exporter of wood products. Therefore, the global demand is highly important to the Swedish wood industry. In Sweden, the demand for wood products has increased not only due to the expansion of the Swedish forest industry's market share but also due to rising global demand for wood and forest products. There are several reasons behind the global increase in demand for wood that together create a complex and interconnected landscape to navigate within.

One of the reasons behind the rapid increase in demand is the changes in demographics globally, where the middle class is growing in populous countries like India, China and the Middle East and North Africa (MENA). This creates a high demand across the global economy by increasing the overall consumption, including a wide range of products where wood plays a vital role. These countries lack a national supply of wooden materials, while there is a strong need for new buildings to accommodate the growing population. In terms of exports, Swedish actors in the wood industry have diversified their customer base by selling to these regions, thereby reducing their dependency on a few selected markets. However, there are also drawbacks to exporting to these types of markets, as their trade patterns can have an impact on the supply chain from a broader perspective. For instance, in Egypt, the major MENA importer of Swedish wood, most business is done through importers at the port of Alexandria, where they buy boatloads from Sweden and then sell to customers across Egypt. These importers tend to exhibit speculative behaviour while waiting for favourable pricing conditions before purchasing. If the importers notice that the prices are likely to decrease, they might hold off buying more wood, which causes a temporary drop in demand. This creates a cycle where buyers become reluctant to purchase when prices start to fall, as they hope prices will continue to decrease. From a long-term perspective, this creates speculative cycles resulting in significant price fluctuations due to a lack of stable demand. This is not only the case for Egypt, as it appears to be a general pattern among customers in the wood industry, both globally and in Sweden.

Another major contributor to the growing demand for wood is increased use of wood in the building industry, which is also strongly impacted by the economic cycles. Since sawn timber is an important building material in the construction industry, the demand for wood is closely connected to the level of activity in the industry. These

levels and the share of new construction projects are strongly related to societies' economic cycles and overall economic state. Aspects such as inflation and interest rates significantly impact these cycles as they create more or less beneficial conditions for starting new building projects. Along with this, there has also been a shift in preferred building materials as the sustainability awareness contributes to increased use of wood. As wood provides stronger environmental advantages than traditional building materials like concrete and steel, it is now being recognised as the more eco-friendly option. The increased use of wood in the construction industry, as well as potential increases due to economic cycles, drives demand for wood upward. In addition to this, there are initiatives such as the New European Bauhaus developed by the EU that aim to encourage the use of wood in construction projects, which might contribute to a further increase in demand.

Moreover, new areas for application of wood are emerging and future projections suggest that the share of wood-based products will continue to grow across various industries (Hurmekoski et al., 2018). For example, when Sweden joined the EU, the constraints on building multi-story buildings in wood were lifted. It created new opportunities for utilising wood materials in construction, thereby increasing demand. In addition, new ways to utilise wood and its characteristics have also been discovered through solutions such as glulam beams, which can substitute for beams made from materials like steel. There are also other industries such as textiles, biofuels, plastics and packaging where wood-based solutions can be applied or replace previous products to reduce the environmental footprint (Hurmekoski et al., 2018). Additionally, directives from the EU, such as the Renewable Energy Directive (RED), promote the use of wood in the energy sector to increase the use of renewable energy sources. These initiatives increase the general demand for wood while influencing the competition between the three main wood assortments, as they encourage a greater share of fuelwood.

Furthermore, major global events and geopolitical factors such as wars, sanctions, and tariffs can greatly impact the demand for wood, but the effects are often hard to predict. For instance, the pandemic triggered an unexpected surge in demand as people invested more in home renovations, leading to historically high wood prices. Assessing how external global events influence the wood market remains a challenge for industry actors. For example, the war between Russia and Ukraine was initially expected to cause major disruptions in roundwood trade, while the actual impact was less severe than anticipated. Yet, such conflict introduces uncertainty in global supply chains where the largest exporting countries are highly exposed. Recently, there has been an increased focus on the potential impacts of tariffs and trade restrictions due to the shift in trade policies in the US. It is difficult to predict how the situation will unfold, particularly since a significant portion of Sweden's wood products are exported. As the sawn timber market is global, changes in tariffs or trade restrictions in major economies such as the US might significantly impact the demand for wood in Sweden and global markets.

4.2.5 Macroeconomics

The Swedish wood industry is embedded in a larger macroeconomic environment and is therefore impacted by changes in macroeconomic factors, both domestically and globally, especially as Sweden plays a significant role as one of the leading exporters of wood products worldwide. These kind of measures ranges from economic cycles, interest rates, inflation and currency fluctuations, as well as correlation with activity levels in the construction industry, particularly when it comes to sawmills and sawn timber. When it comes to the impacts of macroeconomic factors on the Swedish wood market, not all actors within the three main assortments of wood are affected to the same extent.

For instance, the sawmill industry is more sensitive to economic cycles compared to the pulp and paper industry. The sawmill sector in Sweden is particularly volatile as it tends to follow the broader economic cycles, with a clear impact on the profitability of the sawmills. In periods of recession, sawmills face considerable challenges as the production volumes often drop rapidly. On the other hand, during periods of economic growth, the sawmill industry sees a significant expansion of demand for sawn timber. These demand increases are driven by a general increase in the consumption of wood-based products, including segments such as furniture and packaging. Here, the construction industry also plays a crucial role as the level of activity in construction is closely linked to economic cycles, with strong impacts from interest rates and inflation. To be highly reliant on such industries makes the sawmills sector very sensitive to macroeconomic fluctuations, while the possibilities to hedge against these risks are limited.

Further, interest rates play an essential role in shaping the demand for wood products, particularly since they have a high impact on the construction industry. When interest rates rise, borrowing costs increase, which in turn leads to reduced investment in new construction projects. As demand for housing and buildings declines, the need for sawn timber products drops. On the contrary, when interest rates are lower, construction becomes more affordable, which increases demand for wood as the building activity is going upwards. Additionally, inflation influences the wood market in several ways. High inflation can drive up production costs for sawmills, including higher energy costs and labour expenses, which impact the profit margin of the sawmills negatively. Potential inflation can also lead to fluctuations in exchange rates, which may affect the competitiveness of Swedish wood products on the global market.

The value of the Swedish currency SEK is another macroeconomic factor that has a strong effect on Sweden's wood industry, especially in terms of export competitiveness. A weak Swedish currency can benefit Swedish sawmills as it makes their products more affordable for foreign buyers, particularly if those countries have stronger currencies such as the Euro, British Pound, and US Dollar, which are the primary currencies used in the export trade of Swedish wood. In such cases, a weaker Swedish currency can stimulate export demand, boosting production and sales. While a depreciated Swedish currency offers short-term advantages, it also poses long-term challenges. Relying on a weak currency for competitiveness can lead to inflationary

pressures, resulting in reduced purchasing power for Swedish consumers. In addition, a prolonged currency weakness can also introduce uncertainty to the market, which makes it harder for sawmills to make long-term investments. However, in total, it appears that the Swedish wood market has benefited from the decision to retain the Swedish currency SEK instead of adopting the Euro, as the low value of the Swedish currency has been at a feasible level.

When it comes to the sawmill industry, Swedish sawmills closely monitor inventory levels, and they serve as an important short-term indicator for market conditions. When inventories of roundwood are high, it often indicates weak demand as the sawmills may struggle to sell their products and therefore accumulate stock. In such cases, sawmills might reduce production or offer discounts to utilise the materials in the inventory, which can lower prices in the short term. Conversely, low inventory levels at sawmills can signal strong demand, which allows sawmills to maintain or even increase prices. This is a clear indicator that the market is in a high-demand phase, where the increased construction activity is often one of the main contributors. In addition to this, final felling notifications can be tracked to predict the roundwood supply as forest owners need to notify Skogsstyrelsen prior to harvesting (Skogsstyrelsen, n.d.-c). If the number of submitted final felling notifications is low, it might indicate that the roundwood supply will be limited in the coming period. Such temporary supply reductions can lead to reduced production at the sawmills, indicating that the prices are about to rise. However, this can be quite a blunt measure as the conditions on the Swedish wood market cannot be considered as a perfect market due to discrepancies when it comes to market prices fully reflecting the current state of supply and demand.

4.2.6 Regulatory Policies

The wood industry in Sweden is affected by both national and international regulations concerning forest use, deforestation, biodiversity and tariffs. The actors in the industry must adhere to these regulations while simultaneously adapting their operations to effectively manage the implications associated with them. The most significant regulations will be described in the paragraphs below, together with their implication for the actors within the wood industry.

In the EU, lobbying organisations and trade organisations are active for all industries and different opinion-formers, the wood industry being no exception. Before each negotiation round, representatives from the member states receive political directives about what position they should take. To some extent, industry actors can influence these directives. Several trade organisations represent different segments of the forest sector. CEI-Bois, the European Confederation of Woodworking Industries, represent the sawn wood products, the Confederation of European Paper Industries acts on behalf of the pulp and paper industry, and the Confederation of European Forest Owners is the forest owners' association. Forest-related issues have not historically been a major area of interest in the EU until the introduction of the European Green Deal. This has increased the impact of the EU on nations' forest industries. There are several directives and initiatives concerning the wood industry at the European

Union level. However, the effect of these directives depends on the composition of the governments in the member states and in the European Parliament.

The European Green Deal is the EU's strategic plan to become climate-neutral. This includes a wide range of policy areas, many of which affect the wood industry. For example, New European Bauhaus is an initiative to make constructions more sustainable, inclusive and appealing (European Union, n.d.). This increases the use of wooden beams and resource efficiency while constructing buildings. This may have a limited effect in Europe as it is not legally binding. However, in Sweden, the share of houses with wooden frames increased. The Renewable Energy Directive (RED) is another policy that is important for the European Green Deal. This directive's aim is to increase the share of energy produced that is renewable (European Commission, n.d.-d). This increases the demand for renewable energy sources such as fuelwood. This impacts the assortment competition since it stimulates the use of wood as an energy source instead of a material. This has caused the price of fuelwood to rise, sometimes reaching levels comparable to pulpwood (European Commission, n.d.-d).

Another regulation that could impact the wood industry, particularly in the forestry segment of the value chain, is the Land Use, Land-Use Change, and Forestry regulation (LULUCF). LULUCF includes the management of different types of land and the changes in how land is used, for example, to avoid deforestation (European Commission, n.d.-b). The aim of the regulation is to bind more CO2 in the whole EU, where different countries are assigned to bind different amounts of CO2. Sweden has committed to binding more CO2 than any other country, and it does not appear likely that the requirements will be met. The regulation is not only about keeping, but also about increasing, the current carbon storage, which is difficult when the growth of the forest in Sweden has dropped and harvesting levels remain high. There have been some proposals from the Swedish government to compensate forest owners financially if they postpone harvesting their forests.

European Union Deforestation Regulation (EUDR) and the similar and previously used European Union Timber Regulation (EUTR) are regulations that affect the wood industry in Sweden. They are enacted to require that all wood and wooden products that are imported or produced within the EU are harvested with sustainable methods and do not contribute to deforestation, this also includes wood that is harvested to be able to use the land for other purposes (European Commission, 2025). EUTR requires producers to prove that the wooden material they import is legally harvested. This increases the administrative load on the companies sourcing wood outside the EU. In addition, minor actors in the wood industry are concerned that EUDR will increase the need for administration, and therefore, increase the cost for the companies. However, an indirect effect of this regulation is that Sweden may gain a comparative advantage due to its more developed administrative and monitoring system compared to other countries. Conversely, it would increase the overall cost for the industry.

Additional regulation that may affect the wood industry is the Nature Restoration Regulation. This regulation is enacted to increase the biodiversity in the forest,

with different-aged trees and a larger mix of tree species (European Commission, n.d.-c). Further, this means that forest owners will not be able to utilise the common Swedish clear-cutting forestry method. This common method achieves economies of scale through using large machines, as all trees are cut down in the designated area. Therefore, the forest owners and harvesting companies are worried that this will increase the cost of operations. The Nature Restoration Regulation also means that forests with high ecological values must be protected from harvesting. Additionally, companies within the wood industry are also affected by national regulations. In Sweden, the actors need to comply with the environmental code. This code is related to the harvesting and conservation of animals and species. Currently, there is a proposal in development to increase the harvesting, growth and access to sustainable wood. It is possible that a change in the code may increase harvesting possibilities, benefiting both forest owners and the wood industry.

There are uncertainties regarding regulations and government interventions, especially tariffs and how the different regulations interact. The effect of tariffs is currently uncertain. Previously, the idea was that if tariffs were imposed by the US, they would still import Swedish wood products due to the lack of a domestic industry that could satisfy the demand of the market. This would increase the cost for the consumer in the US. However, it is difficult to understand what the consequences would be. For example, tariffs could mean that Canada would export more wood to Europe and take market shares from the Swedish industry. The different regulations that are imposed in Sweden through the EU and the Swedish Government are not totally harmonised, but instead some of the interventions may be contradictory. There are both regulations that would be beneficial for increased wood production and others that limit the wood production. For instance, RED has contributed to an increased demand for fuelwood, given its classification as a renewable energy source. In contrast, LULUCF policies constrain the supply by imposing restrictions on productive land use. This is due to the fact that in the EU, there are different directorate generals with different interests. Therefore, many regulations are a compromise between different parties which makes it more difficult to create aligned policy guidelines.

5
Analysis

In this section, the findings in the empirical data will be analysed based on the market factors from the frame of reference. This will be done by analysing how the underlying mechanisms of the key factors affect the price of wood. The analysis focuses on the Swedish wood market, but also takes into account the global factors and mechanisms. Although the focus of the analysis is on sawn timber, it's important to include sawlogs and roundwood, as some manufacturers use sawlogs to produce packaging.

5.1 Supply and Demand

The available supply of a good or a product is often a key determinant of its market price, nevertheless, in the case of wood (Deaton & Laroque, 1992). In Sweden, the supply of sawn timber is strongly correlated with the availability of roundwood, the primary raw material used in producing sawn timber. Consequently, fluctuations in roundwood supply tend to impact sawn timber prices directly. Although the main part of sawn timber produced in Sweden relies on domestically sourced roundwood, international supply shocks of roundwood can also influence the price nationally, which is the first mechanism presented in Table 5.1. This is consistent with the arguments made by Jacks and Stuermer (2020) about how commodities are generally affected by shocks. Further, the authors argue that supply shocks can influence the price of commodities. However, demand shocks are more common and persist for a longer duration than supply shocks. For example, the COVID-19 pandemic initially disrupted global production chains, resulting in decreased production and availability, leading to a global and national supply shock. Furthermore, the Senior Advisor, the Policy Analyst, and the Researcher claimed during their interviews that the Russian-Ukrainian War created further disturbances in the global supply of roundwood and sawn timber products. This affected Sweden's supply of sawn timber, although Sweden does not import roundwood directly from Russia. The Senior Advisor claims that the trade restrictions that various countries imposed contributed to a decreased aggregated supply in the sanctions imposing countries. Subsequently, this increased demand in other markets, such as Sweden, resulted in upward pressure on the price of sawn timber due to limited supply. This demonstrates how external supply shocks can influence the Swedish market for sawn timber.

The wood industry has recently experienced a shift in the balance between supply and demand, which has affected the dynamics between those, as the demand is becoming larger than the supply. Wood can be considered a renewable resource since

the supply can be regarded as unlimited in the long term. However, as temperate land is needed to produce wood, it competes with other resources operating on such land for production. According to the Policy Analyst, the roundwood supply has historically been higher than the demand, balancing these factors against each other. However, increased demand has led to an increasing supply, resulting in historically high levels of felling. The harvest levels are currently slightly exceeding the growth rate. The supply is becoming saturated, and the possibilities for increasing production are limited, both nationally and globally. The Senior Advisor claims that bark beetle infestations decreased the supply in places such as British Columbia and Europe, which are major suppliers of roundwood around the world. Additionally, the ban on Russian wood reduced the supply and the possibility of a global production increase in the immediate future. This could also exert upward pressure on the price of roundwood and sawn timber. Further, the Senior Advisor elaborates that one place where forests could actively grow is in Russia. It could exert downward pressure on the price of roundwood if this were the case. This mechanism of limited supply could have a moderate to high effect on the price of sawn timber as shown in Table 5.1.

According to the Senior Advisor, the Policy Analyst, and the Researcher, a significant shift has occurred related to the roundwood supply in Sweden. This shift involves the changed relationship that forest owners have with their assets, and, in turn, the behaviours that follow from this new relationship. Statistics from Skogsstyrelsen Skogsstyrelsen (n.d.-a) show that a growing number of forest owners do not reside on and do not actively manage their forest properties to the same extent. This could indicate a shift in perception where forest owners treat their assets more as long-term investments rather than the primary source of income, which the Policy Analyst and the Senior Advisor also mention. Consequently, the practices of the forest owners become less predictable or at least changed from how they usually were. The felling of the forest may be delayed by the owners if there is an anticipation of an increased price in the future. This changed harvest management may introduce greater uncertainty in the wood supply chains. The increased unpredictability of the availability of roundwood can affect the prices of roundwood, which in turn will affect the profitability of producing sawn timber. As presented in Table 5.1, the effect of this mechanism has a moderate increasing impact on the sawn timber price. According to Pindyck (2004), increased volatility can fundamentally affect the production, inventory and prices of commodities. He further argues that volatility increases the total marginal production cost due to the embedded option premium that the producers may have. This may, therefore, result in decreased production as producers anticipate reduced profitability even if prices eventually reach favourable levels.

The demand for a product or raw materials is an important factor to consider when analysing what affects the price (Wu et al., 2020). The demand for sawn timber is closely tied to economic cycles, primarily due to its close connection to the construction industry. The strong connection between sawn timber and the construction industry stems from its widespread use as a construction material (Svenskt Trä, n.d.). Furthermore, the construction industry is closely tied to the economic

cycle, as during financial booms, people and companies anticipate that the situation is favourable for investing in building, construction, and infrastructure projects. Additionally, the demand for sawn timber is also strongly linked to the general economic cycle and increases in consumption in general. Higher consumption means that more packaging is used, as more goods and products need to be transported. This increase in demand can therefore result in increased prices for sawn timber if the supply is stable. Conversely, during economic downturns, reduced construction activity and lower general consumption levels decrease the prices, illustrated with the downwards and upwards pointing arrows in Table 5.1.

Speculative behaviour represents another important factor influencing demand for sawn timber. According to Pindyck (2004), speculative behaviour occurs when the marginal value of storage has the potential to increase, which often happens during high volatility of a material's price. It can also have the effect that actors increase their inventories to ensure stability over the supply. This occurs when the price of the good increases, and there is an opportunity to earn money by holding an additional unit in inventory. An example of this is said to have occurred in Egypt, one of the largest importers of Swedish sawn timber (United Nations Comtrade, 2025). The importers of Egypt import sawn timber when the price is low to build up quantities in their inventory, which they can sell later when the price rises. According to the Senior Advisor, Egypt is a market not prioritised if the demand exceeds the supply. As Table 4.1 illustrates, it is clear that the sawn timber exported to Egypt is of less value per weight than most of the other high-importing countries. A reason presented by the Senior Advisor was that they buy on speculation, and that this specific wood would be difficult to sell elsewhere for the Swedish exporter. However, this speculative behaviour can cause a rise in the sawn timber price in Sweden. As mentioned, there have been changes in how forest owners in Sweden manage their assets, resulting in a tendency towards speculative behaviour. This occurs as owners believe that the value of their holdings in the forest will increase and therefore choose to postpone the felling of the forest. This postponement can deepen the uncertainty in the market, resulting in an increased price of sawn timber. While sawn timber or roundwood is not traded on an organised futures market, the behaviours resemble the dynamics observed during the period of strong contango in commodity markets, described by Tilton et al. (2011). The authors show that there is an increase in speculators during strong contango. In the context of sawn timber, this means that the number of speculators increases, which in turn increases the movements of the price both upward and downward. As seen in Table 5.1, the increase of speculators is one of the demand mechanisms that affects the price of sawn timber both upward and downward.

Demand shocks are also an important mechanism to analyse and understand the price of sawn timber and roundwood. According to Jacks and Stuermer (2020), this is the most common driver for price change for commodities in general. There was a significant demand for sawn timber and its products during the COVID-19 pandemic, driven by increased home renovations both globally and domestically. This strengthened the negotiating power of the sawmills, resulting in a rise in the price of their products, as noted in Table 5.1. According to the Senior Advisor,

sawmills have typically been price takers, meaning they have difficulty passing on costs to their customers. This is because they sell their products on a global market with customers that can choose between a large pool of potential suppliers. In general, the demand for wooden products and, in turn, sawn timber has increased since it is both perceived as a renewable alternative and the middle class in the world is growing. The middle class is growing in countries such as India, China and in MENA, according to (IMF, 2015), which are countries which historically have not had a large wood production. Therefore, the global demand for sawn timber may increase and in turn increase the price of sawn timber, as illustrated in Table 5.1. Although not all these countries may import sawn timber directly from Sweden, the increased demand affects the price of sawn timber in Sweden, as it influences the global dynamics of wood supply and demand.

Table 5.1: *Underlying mechanisms of supply and demand impacting the wood prices in Sweden.*

Key factors	Underlying mechanisms	Price effect
Supply	Supply shocks such as COVID-19 and sanctions following the Russia-Ukraine war.	↑
	Reduced dependency of forest assets as the main source of income among forest owners.	↗
	Limited supply due to saturated possibilities for increased wood production.	↗
Demand	Speculative behaviour among importers causing increased volatility.	↑ or ↓
	Close connection to the construction industry and economic cycles.	↑ or ↓
	Increased demand due to demographic changes on a global level.	↗
	Demand shocks such as increased home renovations during COVID-19.	↑

5.2 Macroeconomic Conditions

There has become an increased demand for forest as an investment type. Such demand aligns with Erb and Harvey (2006) and Hess et al. (2008) findings, who argue that commodities offer effective inflation hedging, and therefore, could be seen as a stable long-term asset. This is especially true during times of high inflation or recession when other financial assets usually underperform. As shown by Kablan et al. (2017) and Kucher and Kurov (2014), investor interest in tangible assets, such as forests, may intensify during recessions due to the perceived safety of such investments. The investments may also be due to speculations that forests will increase in value. This increased investment in forests can increase the price of roundwood and, in turn, sawn timber, as seen in Table 5.2.

The exchange rate of SEK directly affects the price of the sawn timber. This is because Sweden's wood industry is highly dependent on its exports. This could indicate that SEK is a commodity currency, a theory described by Clements and Fry (2008). However, Sweden has other large export categories, demonstrating that this is not the case. Nonetheless, a weaker SEK makes Swedish products cheaper for foreign buyers to buy, boosting exports and demand outside Sweden. In contrast, a strong SEK makes exports more expensive, which may result in increased domestic supply and decreased domestic prices, as it is more challenging to sell them abroad. However, this effect is currency dependent. Therefore, the most substantial impact occurs when the value of SEK appreciates towards the Euro, British Pound, and US Dollar, as most products are sold to these currencies. However, a cheaper SEK in the long term can introduce inflationary pressure and investment uncertainties. Therefore, the value of foreign countries' currencies has a moderate positive or negative price effect, illustrated in Table 5.2.

The Senior Advisor and the Policy Analyst presented one indicator each that can support forecasting of the sawn timber price in Sweden. The first is the sawmills' inventory level. Accumulating or having a high inventory of wooden products at the sawmills can indicate that the price may decrease in the future. The sawmills' full inventory can suggest low demand, and therefore, experience pressure to sell their products at a lower price to continue production. Conversely, a low inventory of sawn timber in the inventories can indicate that the price will rise since the sawmills can build some inventories instead of selling at a lower price. This exerts pressure on the market to increase its offers. However, as argued by Pindyck (2004), high volatility increases the marginal value of storage, resulting in higher inventory levels as a hedge, which could be another reason for accumulating inventories. The second one is the final felling notifications that forest owners need to submit to the Swedish Forest Agency to be allowed to harvest their forest, which can indicate which direction the price is moving. As these notifications must be made 6-12 months in advance, this can be used to predict the roundwood supply in Sweden. Low notification levels can indicate a reduced supply in Sweden, which drives prices upward. Meanwhile, high notification levels can indicate an increasing supply. However, this is described as a blunt indicator, since the wood market is not a perfectly efficient market where prices reflect supply and demand perfectly, since factors such as the global supply also affect the price. Additionally, there is a need for an indicator that visualises the demand, such as GDP or industrial output, as mentioned by Hess et al. (2008) to understand and predict future demand completely.

There may be a connection between the price of sawn timber and the interest rates. This is mainly due to the large demand coming from the construction sector. As mentioned, the construction industry is connected to the interest rates as they increase the willingness to invest in new projects such as houses and infrastructure. Therefore, there is a connection between the price of sawn timber and interest rates, as the price decreases and increases with the activity in the economy. This contradicts what Hess et al. (2008) argues would happen with the commodity prices when interest rates increase or decrease, as they claim that it would be negatively correlated. However, although the interest rates and price of sawn timber are moving

together, there is a lagging effect, as there needs to be trust that it is economically viable for companies and individuals to invest. This mechanism has a strong connection to the demand for sawn timber and, therefore, also the price of sawn timber, both upwards and downwards, as illustrated in Table 5.2.

Table 5.2: *Underlying mechanisms of macroeconomic conditions impacting the wood prices in Sweden.*

Key factor	Underlying mechanisms	Price effect
Macroeconomic Conditions	Increased investment in forests assets.	↗
	Value of SEK compared to the currencies of export markets.	↗ or ↘
	Changes in the interest rate and its connection to the construction industry.	↑ or ↓

5.3 Competition

According to the Policy Analyst and the Senior Advisor, the Swedish wood market has historically been characterised by an oversupply of raw material relative to the demand, which has benefitted the larger players, primarily sawmills, in terms of market power. The bargaining power of these large actors has been further reinforced by their high degree of vertical integration, as described by Jena (2016), allowing them to control much of the value chain. Sweden has a unique ownership structure regarding roundwood supply, as a large number of small private forest owners own the majority of the forest land in Sweden. This differs from the more common ownership structure for commodities as it usually consists of only a few number of sellers, as explained by Hu et al. (2020) and Newbery (1984). From a historical perspective, this has caused an unbalanced power distribution where the larger players have benefited from the oversupply of wood, as it put the small private forest owners in an unfavourable bargaining position. This situation resembles an oligopoly, where a few dominant actors, such as sawmills, control the market as described by Negishi (2014). As a result, this enabled the larger players to maintain low purchasing prices, especially compared to similar actors in other countries.

However, recent shifts in the balance of supply and demand have altered this power dynamic. As the Swedish wood market is facing a situation where demand exceeds supply, this has put small private forest owners in a more favourable position. With limited availability of wood, these owners now have the opportunity to sell their roundwood at higher prices than previously, reversing the power balance in favour of the private owners as presented in Table 5.3. This shift is notable because small private owners, who collectively own the majority of Swedish forest land, are now able to exert more influence over pricing compared to the past, when larger actors had the upper hand. The gradual increase in market power among Swedish private owners may lead to a reduction in the bargaining power of sawmills and an increase

in their purchasing prices. This, in turn, can potentially impact the profitability of the sawmills as they have limited possibilities to transfer cost increases to their customers, as the price of sawn timber is set globally.

The relationship between small private forest owners and forest industry groups is another critical factor in understanding the price dynamics of Swedish wood. The Swedish private forest owners are heavily dependent on industry groups for services such as advice, access to the market and support in the harvesting and processing of roundwood. From a historical perspective, the relationship between small private forest owners and forest industry groups has been characterised by the power imbalance between the two parties. The forest industry group act both as an advisor and a customer simultaneously, which results in industry groups having great control over market outcomes. This is not only a question about dependency based on needed services, but also on information which is emphasised by Clarkson et al. (2007) and illustrated in Table 5.3. The forest industry groups have a broad view of the market regarding supply availability, market conditions and the current state of demand based on various sources. On the other hand, private forest owners are highly reliant on information from industry groups. This information asymmetry can contribute to inefficiency in price formation as the discrepancy puts the industry group in a favourable position for price negotiations.

Additionally, the Researcher explain that there is not only competition between different actors on the Swedish market, but also between the three main assortments of wood, sawlogs, pulpwood, and fuelwood as presented in Table 5.3. The limited wood supply has heightened the importance of the share between these assortments in terms of pricing. Sawmills, which traditionally focus on sawlogs, now face competition from the demand for fuelwood due to the growing interest in renewable energy sources. This increased competition for roundwood can potentially drive up sawlogs' price as sawmills compete with energy producers for access to wood. Further, regulations aim to increase the share of fuelwood in energy production. This could increase competition and shift the supply and demand balance in favour of fuelwood, potentially leading to price increases for sawlogs. Yet, it is difficult to predict how sawn timber prices will be impacted if such changes remain for a longer period.

Table 5.3: *Underlying mechanisms of competition impacting the wood prices in Sweden.*

Key factor	Underlying mechanisms	Price effect
Competition	Increased bargaining power among small private forest owners.	↗
	Forest industry groups have access to more information about the market than small private forest owners.	↘
	Increased competition from other assortments, such as fuelwood.	↗

5.4 Market Integration

Further, the Swedish wood market operates in a dual context in terms of pricing as roundwood is purchased at a domestic or regional price while sawn timber is subject to global commodity pricing. According to Jena (2016) and Goodwin et al. (2021), this implies that the market for sawn timber is integrated on a global level while the roundwood market is not. This distinction plays a critical role in the price formation process as local factors primarily determine the price of sawlogs. At the same time, sawn timber is influenced by global market conditions as described in Table 5.4. Additionally, the cost of transporting roundwood further complicates the market dynamics. Due to their size and low value relative to their weight, sawlogs are expensive to transport over long distances. This limits the feasibility of moving sawlogs to distant markets before adding value, which, as described by Jena (2016), causes market segmentation due to the lack of price transmission. In contrast, sawn timber can be shipped more efficiently due to its higher value per unit weight, making it easier to trade internationally.

Given the pricing structure of sawlogs and sawn timber, where domestic conditions influence sawlog pricing while sawn timber prices are set on the global market, the possibilities of transferring cost increases to customers are limited. The Senior Advisor claim that Swedish sawmills are currently facing a situation where the operational costs are increasing. At the same time, the bargaining power among the private forest owners seems to increase, leading to higher purchasing prices of sawlogs. If the cost increases are significant, there is a risk that the total costs will exceed sales, resulting in implications for the profitability of the sawmills. If such a situation persists over time, sawmills might close down as they are not profitable enough to continue their business.

Furthermore, there is also risk for geopolitical disruptions, such as introduction of new tariffs or regulations as presented in Table 5.4, which can have a significant impact on market integration as previously highlighted by Donaldson (2015), Goodwin and Piggott (2001) and Jena (2016). Tariffs on Swedish wood products can reduce demand for Swedish sawn timber in specific international markets, while the costs of selling Swedish sawn timber to international markets increase. These tariffs can create distortions in the market by limiting the flow of wood products, ultimately disrupting international trade routes and reducing competition. In addition, regulations related to Swedish forestry and the Swedish wood industry, especially from an EU perspective, can have implications further explained in subsection 5.5.

Moreover, the lack of an established commodity market for sawlogs and sawn timber presents another disruption to market integration as illustrated in Table 5.4. The absence of a standardised exchange for wood products means that pricing transparency is limited. For sawlogs and sawn timber, there are no universal criteria for the material being traded, making it difficult for buyers and sellers to agree on common standards, as explained by Radetzki and Wårell (2016). The wide variety of wood species, where each tree is unique, combined with specific use cases and

different quality requirements, complicates the creation of a unified market. Consequently, the lack of a clear market exchange for sawlogs and sawn timber contributed to price opacity, reducing the efficiency of price discovery on a broader scale.

Table 5.4: *Underlying mechanisms of market integration impacting the wood prices in Sweden.*

Key factor	Underlying mechanisms	Price effect
Market Integration	Discrepancy between domestic sawlog prices and global sawn timber prices.	→
	Potential impacts of tariffs and new regulations.	↗
	Lack of standardised exchanges of sawlogs and sawn timber.	↗

5.5 Regulations

There are various regulatory policies, which primarily can be categorised as environmental regulations according to OECD (2011), that play a substantial role in shaping the Swedish wood market. As the extraction rights of Swedish forests are offered to private companies, this causes a need for regulation to reduce environmental impacts as described by Kowalski and Legendre (2023). These regulations can, from a market perspective, influence the supply and demand dynamics over time and indirectly impact the wood prices in the long term. Although regulations do not directly set prices, their impact on market behaviour can have significant consequences on both the availability of wood and the costs incurred by sawmills. From a supply side perspective, regulations such as the Land Use, Land Use Change and Forestry regulation (LULUCF) aim to reduce greenhouse gas emissions associated with land use changes and forestry practices as stated by the European Commission (n.d.-b). Industry experts argue that by restricting land use changes, LULUCF may reduce the overall supply of wood available for harvesting. As a result, these restrictions could reduce the volume of roundwood entering the market, potentially driving up prices due to the decreased availability of raw material as presented in Table 5.5. While these regulations aim to promote sustainability, they can increase the cost of raw wood in the long term by limiting supply.

In terms of demand, there are regulations such as the Renewable Energy Directive (RED) that is designed to promote the use of fuelwood as a renewable energy source (European Commission, n.d.-d). This regulation increases demand for fuelwood, which links to the competition for shares between the three main wood assortments as illustrated in Table 5.5. When the demand for fuelwood increases, the assortment share of fuelwood might increase, which in turn impacts the availability of sawlogs and sawn timber. This can further affect the prices of sawlogs as the overall demand for roundwood increases while the supply is limited, placing upward pressure on the prices. Given the potential reduction or retention of supply from the LULUCF

directive, this can be contradictory as RED increased demand for wood, which then further contributes to the gap between supply and demand.

There are also regulations such as the European Union Timber Regulation (EUTR) and European Union Deforestation Regulation (EUDR) with indirect impacts on the Swedish wood industry as presented in Table 5.5. The EUTR aims to prevent the trade of illegally harvested roundwood by requiring companies to prove that the roundwood they import into the EU is legally sourced (European Commission, 2025). This regulation can limit the potential for increasing the supply of wood through imports from non-EU countries that do not meet the required sustainability standards. The regulation can also increase the costs of compliance for companies involved in the wood trade, as they must ensure their supply chains are traceable and meet legal requirements. This can cause major challenges for smaller actors as the administration workload becomes unmanageable due to the size of their organisation.

Furthermore, EUDR aims to reduce deforestation associated with the EU's consumption of certain commodities, including wood (European Commission, 2025). By requiring that wood entering the EU is not associated with deforestation, this regulation may limit the supply of roundwood from certain regions that do not meet the sustainability criteria. The implementation of this regulation could also affect the cost of roundwood imports, as suppliers must ensure that their products meet sustainability standards. While the intention is to promote sustainable forestry practices, this can have other implications for the wood industry as a whole. The EUDR regulation also poses a risk of imposing administrative requirements that can add costs to sawmills. These costs add financial pressure on sawmills, particularly as they cannot easily pass cost increases to customers due to the market-based pricing structure for sawn timber. The cumulative effect of these regulatory requirements can reduce sawmills' profitability, especially as they must balance compliance with competitive pricing pressures.

Table 5.5: *Underlying mechanisms of regulations impacting the wood prices in Sweden.*

Key factor	Underlying mechanisms	Price effect
Regulations	Reduced supply of wood due to the LULUCF regulation.	↗
	Increased share of fuelwood due to RED.	↗
	EUTR and EUDR increase administrative costs.	→

6
Discussion

This chapter discusses the structural and contextual aspects concerning the key pricing factors and underlying mechanisms shaping the Swedish wood market, which includes market characteristics, material characteristics, and external uncertainties.

6.1 Market Characteristics

As a basis, this thesis has focused primarily on the Swedish wood market, specifically the market for sawn timber. While Sweden represents a mature and structured forest market with unique characteristics, this focus naturally limits the transferability of conclusions to other markets. The Swedish context, characterised by a high degree of private forest ownership and a vertically integrated value chain, presents specific market conditions that may not be directly replicable elsewhere. Moreover, the Swedish market is intertwined with policies and regulations developed by the EU, such as LULUCF and EUDR, which focus on sustainable forest harvesting. From a broader perspective, this can impact supply constraints and administrative procedures, while limiting the applicability of the findings to other markets, particularly those outside the EU.

These factors, alongside Sweden's reliance on exports and its sensitivity to currency fluctuations, mean that both local supply conditions and international demand shape price formation mechanisms for sawn timber. This dual exposure makes the Swedish wood market complex. Additionally, other markets operate under different regulatory, geopolitical, and economic conditions, making each market unique. However, there are insights from the Swedish market that can contribute towards broader discussion, especially regarding structural shifts in supply and demand. The interplay between increasing demand for renewable materials, saturation of harvestable forest land, and increasing regulatory pressures presents challenges that other forestry markets may also face. In addition, the dynamics of competition between the three main assortments, sawlogs, pulpwood and fuelwood, also highlight how changing political and environmental priorities can shift internal market balances.

Further, it is important to recognise that the Swedish wood market is deeply embedded in the global market, particularly for sawn timber, making it highly sensitive to international developments. Due to the strong connection between the Swedish and global markets, multiple forces act simultaneously, such as economic cycles, policy changes, and shifting consumption patterns, which can overlap and sometimes even contradict. This creates a highly complex environment as several mechanisms

interact at the same time, both on a national and global level. For instance, international demand growth, driven by demographic shifts and sustainability goals, intersects with national regulations and local supply constraints, amplifying volatility and reducing the predictability of price signals. Therefore, understanding the Swedish wood market requires considering the interplay of these, sometimes conflicting, mechanisms that shape domestic and international market conditions.

6.2 Material Characteristics

It is also important to emphasise the unique material characteristics of wood, which influence its segmentation. The tree is divided into three main assortments, sawlogs, pulpwood and fuelwood, where each assortment serves various markets with different segments. Particularly, sawn timber is characterised by many customer segments depending on which part of the tree has been processed and what it is intended to be used for, such as construction, furniture or packaging. This segmentation increases market complexity and affects the pricing structure. Further, this product diversity makes wood a versatile yet fragmented commodity, which complicates standardisation and price transparency, highlighting the opportunities and challenges related to market integration and competition. Additionally, as previously mentioned, there are several new areas for the application of wood which might contribute to an increase in demand. However, potential substitutes can also present a dual role in terms of demand dynamics, as they might reduce demand for wood products, certainly if price levels rise significantly because of regulations restricting supply. On the other hand, as noted in the empirical findings, new applications and increased demand for sustainable materials, especially in packaging and construction, can counterbalance these effects. This underscores the need to continuously monitor substitutes related to wood that can impact the demand as well as emerging market opportunities.

As previously described, sawn timber has unique characteristics that make it less suitable for trading on a standardised commodity exchange. Wood is a diverse material with a wide range of applications, primarily due to its heterogeneous structure and properties. While this diversity benefits usage, it poses an obstacle to standardisation. It is essential that a commodity's quality is easily determinable in order to specify the conditions of future contracts. However, in the case of sawn timber, factors such as dimensions, tree species, whether it is softwood or hardwood, and where it is produced can vary significantly. This variety likely contributes to the absence of an established future market exchange for sawn timber or sawlogs in Europe. Additionally, even if the material could be adequately specified, there could be challenges in ensuring sufficient numbers of buyers and sellers to provide a proportionate level of liquidity to these contracts. Since adequately specified futures would require detailed descriptions, it could limit the number of potential buyers. This could be some reasons to why sawn timber does not have a standardised commodity exchange, despite being a commodity that is traded in large quantities globally.

6.3 External Uncertainties

Finally, external uncertainties such as tariffs, regulatory changes and geopolitical events continue to influence supply chains and price formations, while it's challenging to anticipate how each change will actually affect the market. For instance, Sweden does not import roundwood from Russia, but trade disruptions and sanctions have affected the global wood market, indirectly impacting Swedish producers. Further, tariffs represent a particularly volatile risk as the implementation is often driven by shifting political agendas and trade relations, making them difficult to predict. New tariffs could significantly reduce competitiveness by raising prices or limiting market access for a heavily export-oriented industry like Swedish sawn timber. On the other hand, if such tariff changes targeted exporting countries other than Sweden, this could result in temporary advantages for Swedish producers. However, these gains are uncertain and likely to be short-lived. In parallel, regulatory changes within the EU, such as those tied to environmental and sustainability goals, may increase compliance costs for Swedish actors while also affecting supply chain dynamics. The unpredictability of these external factors highlights the importance of continuously monitoring market changes and building strategic flexibility for the Swedish sawn timber industry to manage them.

7
Conclusion

This thesis is set out to identify the key pricing factors of wood packaging and analyse how underlying mechanisms within each of these key factors affect pricing, based on wood packaging used within the case company. The findings reveal that the pricing of wood, particularly sawn timber and sawlogs, is shaped by a complex set of interrelated mechanisms which are summarised in Table 7.1. As the two research questions are closely intertwined, both questions will be answered simultaneously. Finally, recommendations for future research will be outlined based on the findings.

RQ1: *What are the key pricing factors of the wood packaging used by the case company?*

RQ2: *How do underlying mechanisms of these key factors affect the pricing?*

The findings indicate that the interplay between supply and demand is one of the most dominant forces driving the wood prices. A critical supply-side challenge is the impact of unpredictable supply shocks such as COVID-19 and the Russia-Ukraine war, which limit the wood availability and push prices upwards. Other mechanisms, such as forest owners' shifting reliance on forestry as a primary income source and limited possibilities to increase the harvest areas, imply supply constraints. These issues contribute to rising prices as demand continues to outpace the available supply. From the demand side, speculative behaviours among both forest owners and importers are causing unharmonised supply chains. Forest owners have a tendency to delay harvest when anticipating high prices, while importers tend to postpone new purchases when anticipating lower prices, which causes strong price fluctuations. Additionally, the link between the sawn timber industry and the construction industry ties the demand for this type of wood to the broader economic cycles. There are also global demographic changes, such as general population growth and a growing middle class, that drive the demand further. In addition, different types of demand changes can impact the wood prices, where the home renovation boom during COVID-19 is one example, driving up prices.

Macroeconomic conditions introduce another dimension of complexity. Increased investment in forest land, seen as a hedge against inflation and economic uncertainty, contributes to long-term price increases. Currency exchange rates also play a pivotal role in shaping the wood prices. For instance, a weakened Swedish currency (SEK) relative to other trading markets makes Swedish wood products more attractive on

the international market. However, such currency benefits for export competitiveness are only short-term and not considered sustainable in the long term. Moreover, interest rates indirectly shape demand through their influence on the construction sector, reinforcing the link between macroeconomic cycles and wood prices.

In terms of competition, the Swedish forest sector is undergoing a gradual shift of market power. The Swedish wood industry has traditionally been dominated by larger actors such as vertically integrated sawmills, but now the market has become more balanced as private forest owners gain bargaining power due to tighter supply, which can lead to increased sawlog prices. On the contrary, a high number of small private owners are still members of the forest industry groups, which have access to more market information, causing information asymmetries, potentially inhibiting price increases and increasing the risk for dependency. Simultaneously, competition between different wood assortments, especially sawlogs and fuelwood, has intensified, largely due to policy-driven incentives to increase renewable energy sources, affecting availability and pricing.

Market integration is another factor highly affecting the interaction and exchange of wood between different markets. A fundamental disconnection exists, roundwood is often priced domestically, or even regionally, while sawn timber is sold on the global market. This limits the ability of Swedish domestic producers to transfer increased raw material costs to international buyers. The different conditions of pricing for sawlogs and sawn timber combined with the recent shift to increased bargaining power among private forest owners, imply challenges for the sawmills to remain profitable. Additionally, tariffs and new regulations further complicate international market access and price stability. Trade barriers imposed by importing countries can reduce the competitiveness of Swedish sawn timber as they directly affect pricing and demand. Further, the lack of standardised commodity exchange of sawlogs and sawn timber contributes to inefficiencies in price formation and reduces transparency. The absence of universally accepted specifications and a trading platform complicates price discovery and increases the risk of asymmetric information.

Lastly, regulatory factors are playing an influential role in terms of wood pricing. Environmental regulations driven by the EU are increasingly shaping the wood market by placing constraints on supply. Regulations such as LULUCF limit the availability of harvestable forest land, while directives like RED aim to boost demand for specific assortments, such as fuelwood, to increase the share of renewable energy. In addition, regulations such as EUTR and EUDR add administrative complexity and compliance costs, particularly for smaller actors who may lack the capacity to adapt to these requirements. Although these regulations aim to promote sustainability, they can distort market dynamics and reduce competitiveness.

Table 7.1: *Key factors and underlying mechanisms impacting the wood prices in Sweden.*

Key factors	**Underlying mechanisms**	**Price effect**
Supply	Supply shocks such as COVID-19 and sanctions following the Russia-Ukraine war.	↑
	Reduced dependency of forest assets as the main source of income among forest owners.	↗
	Limited supply due to saturated possibilities for increased wood production.	↗
Demand	Speculative behaviour among importers causing increased volatility.	↑ or ↓
	Close connection to the construction industry and economic cycles.	↑ or ↓
	Increased demand due to demographic changes on a global level.	↗
	Demand shocks such as increased home renovations during COVID-19.	↑
Macroeconomic Conditions	Increased investment in forests assets.	↗
	Value of SEK compared to the currencies of export markets.	↗ or ↘
	Changes in the interest rate and its connection to the construction industry.	↑ or ↓
Competition	Increased bargaining power among small private forest owners.	↗
	Forest industry groups have access to more information about the market than small private forest owners.	↘
	Increased competition from other assortments, such as fuelwood.	↗
Market Integration	Discrepancy between domestic sawlog prices and global sawn timber prices.	→
	Potential impacts of tariffs and new regulations.	↗
	Lack of standardised exchanges of sawlogs and sawn timber.	↗
Regulations	Reduced supply of wood due to the LULUCF regulation.	↗
	Increased share of fuelwood due to RED.	↗
	EUTR and EUDR increase administrative costs.	→

7.1 Future Research

This thesis has mainly focused on sawlogs and sawn timber due to its relevance to the packaging solutions used by the case company. However, future research could benefit from a more holistic examination of all three wood assortments, sawlogs, pulpwood and fuelwood. A deeper investigation into the interrelationships between these assortments would provide a more nuanced understanding of how competition between them influences pricing and availability across the market. Such research could also explore the driving forces behind shifts in assortment shares, such as changes in energy regulations and impacts of pulp demand. To study how these assortments compete or co-exist under constrained supply scenarios could help to further inform long-term strategic decisions for companies operating within the forestry value chain. Another area for future explorations is cross-market comparisons, as other countries might operate under different market conditions, especially when it comes to ownership structure, forest management practices and policy environments. This could offer a broader insight into the transferability of Sweden's forestry model and market behaviour, highlighting both differences and similarities with other markets.

Additionally, quantitative research could be conducted to further understand the size of the effect these mechanisms have on the price of sawn timber in Sweden. This would support the understanding of what mechanisms are most important to monitor. However, problems with quantifying some of the mechanisms could emerge due to their complex characteristics. Other areas for future research are to examine the two indicators of future price presented during the interviews, final felling notifications and inventory levels at the sawmills. A better understanding of these indicators could support the case company and other companies to mitigate unnecessarily high prices due to price fluctuations. Further, examining the performances of different approaches that could mitigate the exposure to price fluctuations of sawn timber using the knowledge of the key pricing factors and their underlying mechanisms is also a suitable future research topic related to this area.

Bibliography

Akram, Q. F. (2009). Commodity prices, interest rates and the dollar. *Energy Economics*, *31*(6), 838–851. https://doi.org/10.1016/j.eneco.2009.05.016

Anderson, D. A., Hamori, S., & Hamori, N. (2001). An empirical analysis of the efficiency of the Osaka Rice Market during Japan's Tokugawa Era. *Journal of Futures Markets*, *21*(9), 861–874. https://doi.org/10.1002/FUT.1905

Andersson, E., & Keskitalo, E. C. H. (2019). Service logics and strategies of Swedish forestry in the structural shifts of forest ownership: challenging the "old" and shaping the "new". *Scandinavian Journal of Forest Research*, *34*(6), 508–520. https://doi.org/10.1080/02827581.2019.1604990

Andrikopoulos, D., & Stoforos, C. (2023). Review of Literature on Studies of Market Integration. *SPOUDAI Journal of Economics and Business*, *73*(3-4), 81–104. http://spoudai.org/index.php/journal/article/view/544

Arnett, D. B., Dass, M., & Bhoumik, K. (2021). Re-examining market structures: Resource-Advantage theory and the market offering ecosystem perspective. *Journal of Global Scholars of Marketing Science*, *31*(2), 189–199. https://doi.org/https://doi.org/10.1080/21639159.2020.1785917

Bartle, I., & Vass, P. (2007). Independent economic regulation: A reassessment of its role in sustainable development. *Utilities Policy*, *15*(4), 261–269. https://doi.org/10.1016/J.JUP.2007.06.001

Bell, E., Bryman, A., & Harley, B. (2022). *Business research methods* (6th ed.). Oxford University Press.

Bergman, M. (2024). *Konkurrens på rundvirkesmarknaden Kunskapsunderlag*. Skogsstyrelsen. https://www.skogsstyrelsen.se/globalassets/om-oss/rapporter/rapporter-2024/rapport-2024-07-konkurrens-pa-rundvirkesmarknaden.pdf

Boungou, W., & Yatié, A. (2024). Uncertainty, stock and commodity prices during the Ukraine-Russia war. *Policy Studies*, *45*(3-4), 336–352. https://doi.org/10.1080/01442872.2024.2302440

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706QP063OA

Bryman, A., Clark, T., Foster, L., & Sloan, L. (2021). *Bryman's Social Research Methods* (6th ed.). Oxford University Press.

Carter, C. A., & MacLaren, D. (1997). Price or quantity competition? Oligopolistic structures in international commodity markets. *Review of International Economics*, *5*(3), 373–385. https://doi.org/10.1111/1467-9396.00063

Choong, M. K., Galgani, F., Dunn, A. G., & Tsafnat, G. (2014). Automatic evidence retrieval for systematic reviews. *Journal of Medical Internet Research*, *16*(10). https://doi.org/10.2196/jmir.3369

Clarkson, G., Jacobsen, T. E., & Batcheller, A. L. (2007). Information asymmetry and information sharing. *Government Information Quarterly*, *24*(4), 827–839. https://doi.org/10.1016/J.GIQ.2007.08.001

Clements, K. W., & Fry, R. (2008). Commodity currencies and currency commodities. *Resources Policy*, *33*(2), 55–73. https://doi.org/10.1016/j.resourpol.2007.10.004

Cooper, R. N., Lawrence, R. Z., Bosworth, B., & Houthakker, H. (1975). The 1972-75 Commodity Boom. *Brookings Papers on Economic Activity*, (3). https://doi.org/https://doi.org/10.2307/2534151

Deaton, A., & Laroque, G. (1992). On the Behaviour of Commodity Prices. *The Review of Economic Studies*, *59*(1), 1–23. https://doi.org/10.2307/2297923

Donaldson, D. (2015). The Gains from Market Integration. *Annual Review of Economics*, *7*(1), 619–647. https://doi.org/https://doi.org/10.1146/annurev-economics-080213-041015

Erb, C. B., & Harvey, C. R. (2006). The strategic and tactical value of commodity futures. *Financial Analysts Journal*, *62*(2), 69–97. https://doi.org/10.2469/faj.v62.n2.4084

European Commission. (2025). *Regulation on Deforestation-free products*. https://environment.ec.europa.eu/topics/forests/deforestation/regulation-deforestation-free-products_en

European Commission. (n.d.-a). *Glossary:Commodity - Statistics Explained*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Commodity

European Commission. (n.d.-b). *Land use sector*. https://climate.ec.europa.eu/eu-action/land-use-sector_en

European Commission. (n.d.-c). *Nature Restoration Regulation*. https://environment.ec.europa.eu/topics/nature-and-biodiversity/nature-restoration-regulation_en

European Commission. (n.d.-d). *Renewable Energy Directive*. https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en

European Union. (n.d.). *New European Bauhaus: beautiful, sustainable, together*. https://new-european-bauhaus.europa.eu/index_en

Goodwin, B. K., Holt, M. T., & Prestemon, J. P. (2021). Semi-parametric models of spatial market integration. *Empirical Economics*, *61*(5), 2335–2361. https://doi.org/10.1007/S00181-020-01985-2

Goodwin, B. K., & Piggott, N. E. (2001). Spatial Market Integration in the Presence of Threshold Effects. *American Journal of Agricultural Economics*, *83*(2), 302–317. https://doi.org/10.1111/0002-9092.00157

Gorton, G., & Geert Rouwenhorst, K. (2006). Facts and fantasies about commodity futures. *Financial Analysts Journal*, *62*(2), 47–68. https://doi.org/10.2469/faj.v62.n2.4083

Gustavsson, M., & Säfsten, K. (2019). *Forskningsmetodik för ingenjörer och andra problemlösare* (1st ed.). Studentlitteratur.

Henriksson, F., Johansen, K., & Schütte, S. (2021). Challenges when working with renewable materials: knocking on wood? *International Journal of Sustainable Engineering*, *14*(6), 1980–1987. https://doi.org/10.1080/19397038.2021.1970854

Hess, D., Huang, H., & Niessen, A. (2008). How do commodity futures respond to macroeconomic news? *Financial Markets and Portfolio Management*, *22*(2), 127–146. https://doi.org/10.1007/s11408-008-0074-x

Hu, M., Zhang, D., Ji, Q., & Wei, L. (2020). Macro factors and the realized volatility of commodities: A dynamic network analysis. *Resources Policy*, *68*, 101813. https://doi.org/10.1016/j.resourpol.2020.101813

Hurmekoski, E., Jonsson, R., Korhonen, J., Jänis, J., Mäkinen, M., Leskinen, P., & Hetemäki, L. (2018). Diversification of the forest industries: Role of new wood-based products. *Canadian Journal of Forest Research*, *48*(12), 1417–1432. https://doi.org/10.1139/cjfr-2018-0116

IMF. (2015, April). *World Economic Outlook, April 2015: Uneven Growth*. International Monetary Fund. https://www.imf.org/en/Publications/WEO/Issues/2016/12/31/World-Economic-Outlook-April-2015-Uneven-Growth-42382

Jacks, D. S., & Stuermer, M. (2020). What drives commodity price booms and busts? *Energy Economics*, *85*. https://doi.org/10.1016/J.ENECO.2018.05.023

Jena, P. K. (2016). Commodity market integration and price transmission: Empirical evidence from India. *Theoretical and Applied Economics*, *23*(3(608)), 283–306.

Jonsson, R. (2024). *Strategic wood availability in Europe*. Swedish University of Agricultural Sciences. https://res.slu.se/id/publ/131503

Kablan, S., Ftiti, Z., & Guesmi, K. (2017). Commodity price cycles and financial pressures in African commodities exporters. *Emerging Markets Review*, *30*, 215–231. https://doi.org/10.1016/j.ememar.2016.05.005

Kharas, H. (2010, January). *The Emerging Middle Class in Developing Countries*, OECD Development Centre Working Papers. https://doi.org/10.1787/5KMMP8LNCRNS-EN

Kowalski, P., & Legendre, C. (2023, April). *Raw Materials Critical for the Green Transition: Production, International Trade and Export Restrictions*. OECD.

Kucher, O., & Kurov, A. (2014). Business cycle, storage, and energy prices. *Review of Financial Economics*, *23*(4), 217–226. https://doi.org/10.1016/j.rfe.2014.09.001

Laffont, J.-J., & Tirole, J. (1991). The Politics of Government Decision-Making: A Theory of Regulatory Capture. *Quarterly Journal of Economics*, *106*(4), 1089–127.

Leavy, P. (2020). *The Oxford Handbook of Qualitative Research*. Oxford University Press. https://doi.org/10.1093/OXFORDHB/9780190847388.001.0001

Negishi, T. (2014). *Developments of International Trade Theory* (2nd ed., Vol. 2). Springer Japan. https://doi.org/10.1007/978-4-431-54433-3

Newbery, D. M. (1984). Commodity Price Stabilization in Imperfect or Cartelized Markets. *Econometrica*, *52*(3), 563–578. https://doi.org/10.2307/1913465

Newbery, D. M. (1999). *Privatization, Restructuring and Regulation of Network Industries*. MIT Press. https://doi.org/10.7551/mitpress/5579.001.0001

Nnaji, U. O., Benjamin, L. B., Eyo-Udo, N. L., & Etukudoh, E. A. (2024). Effective cost management strategies in global supply chains. *International Journal of Applied Research in Social Sciences*, *6*(5), 945–953. https://doi.org/10.51594/IJARSS.V6I5.1146

OECD. (2011). *Regulatory policy and governance: Supporting economic growth and serving the public interest*. OECD Publishing. https://doi.org/10.1787/9789264116573-EN

Ozeranska, S. (2021). Systematization of Monopolies as a Condition for Effective Legal Limitation of Monopolism. *Evropsky Politicky a Pravni Diskurz*, *8*(6), 63–66. https://doi.org/10.46340/eppd.2021.8.6.10

Patel, R., & Davidsson, B. (2019). *Forskningsmetodikens grunder: Att planera, genomföra och rapportera en undersökning* (Fifth edition). Studentlitteratur.

Peltzman, S. (1976). Toward a More General Theory of Regulation. *Journal of Law and Economics*, *14*, 109–48.

Pindyck, R. S. (2004). Volatility and commodity price dynamics. *Journal of Futures Markets*, *24*(11), 1029–1047. https://doi.org/10.1002/fut.20120

Powell, R., Vo, D. H., & Pham, T. N. (2019). Cattle as a consistently resilient agricultural commodity. *Applied Economics*, *51*(55), 5911–5922. https://doi.org/10.1080/00036846.2019.1631441

Radetzki, M., & Wårell, L. (2016). *A handbook of primary commodities in the global economy* (2nd Edition). Cambridge University Press. https://doi.org/10.1017/9781316416945

Rashid, S. Commodity Exchanges and Market Development: What Have we Learned? In: 2015. https://doi.org/10.22004/AG.ECON.212488

Redmond, W. (2013). Three Modes of Competition in the Marketplace. *American Journal of Economics and Sociology*, *72*(2), 423–446. https://doi.org/10.1111/AJES.12011

Salop, S. (1976). Information and Monopolistic Competition. *The American Economic Review*, *66*(2), 240–245.

Skogsindustrierna. (2024, November). *Snabba fakta*. https://www.skogsindustrierna.se/om-skogsindustrin/branschstatistik/snabba-fakta/

Skogsindustrierna. (2025, April). *Ekonomisk betydelse och välfärd*. https://www.skogsindustrierna.se/om-skogsindustrin/branschstatistik/ekonomisk-betydelse-och-valfard/

Skogsstyrelsen. (2023a, May). *04. Antal skogsägare (fysiska personer). efter Storleksklass, Kön och År. PxWeb*. https://pxweb.skogsstyrelsen.se/pxweb/sv/Skogsstyrelsens%20statistikdatabas/Skogsstyrelsens%20statistikdatabas__Fastighets-%20och%20agarstruktur/PX04.px/table/tableViewLayout2/?rxid=03eb67a3-87d7-486d-acce-92fc8082735d

Skogsstyrelsen. (2023b). *Avverkningens volym och penningvärde (löpande priser) efter Typ av värde, Sortiment och År. PxWeb*. https://pxweb.skogsstyrelsen.se:443/sq/93b3ec2c-59b0-4528-bf2d-beca1587ae47

Skogsstyrelsen. (n.d.-a). *Fastighets- och ägarstruktur i skogsbruk*. https://www.skogsstyrelsen.se/statistik/fastighets--och-agarstruktur-i-skogsbruk/

Skogsstyrelsen. (n.d.-b). *Rundvirkespriser*. https://www.skogsstyrelsen.se/statistik/ekonomi/rundvirkespriser/

Skogsstyrelsen. (n.d.-c). *Statistik om avverkningsanmälningar*. https://www.skogsstyrelsen.se/statistik/avverkning/avverkningsanmalningar/

Skogsstyrelsen. (n.d.-d). *Sysselsättning i skogsbruket*. https://www.skogsstyrelsen.se/statistik/arbetskraft/sysselsattning-i-skogsbruket/

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, *104*, 333–339. https://doi.org/10.1016/J.JBUSRES.2019.07.039

Statistiska centralbyrån. (2024, April). *Sveriges BNP*. https://www.scb.se/hitta-statistik/sverige-i-siffror/samhallets-ekonomi/bnp-i-sverige/#BNPar

Stigler, G. (1971). The Theory of Economic Regulation. *Bell Journal of Economics and Management*, *2*(1), 3–21.

Svenskt Trä. (n.d.). *Från råvara till material*. https://www.svenskttra.se/trafakta/allmant-om-tra/fran-timmer-till-planka/

Sveriges Riksbank. (2024). *Vad är inflation?.* https://www.riksbank.se/sv/penningpolitik/inflationsmalet/vad-ar-inflation/

The Federal Reserve. (2021). *The Fed Explained: What the Central Bank Does*. Board of Governors of the Federal Reserve System. https://doi.org/10.17016/0199-9729.11

Tilton, J. E., Humphreys, D., & Radetzki, M. (2011). Investor demand and spot commodity prices. *Resources Policy*, *36*(3), 187–195. https://doi.org/10.1016/J.RESOURPOL.2011.01.006

United Nations. (2006). *Standard International Trade Classification Revision 4*. https://unstats.un.org/unsd/publication/SeriesM/SeriesM_34rev4E.pdf

United Nations Comtrade. (2025). *UN Comtrade Database*. https://comtradeplus.un.org/TradeFlow?Frequency=A&Flows=X&CommodityCodes=4407&Partners=0&Reporters=752&period=2024&AggregateBy=none&BreakdownMode=plus

von Auer, L., & Pham, T. A. (2021). Optimal destabilization of cartels. *Journal of Regulatory Economics*, *59*(2), 175–192. https://doi.org/10.1007/S11149-021-09425-4/TABLES/1

Wlazlowski, S. (2003). Petrol and Crude Oil Prices: Asymmetric Price Transmission. *Ekonomia*, *11*, 1–25. https://www.researchgate.net/publication/24112625_Petrol_and_Crude_Oil_Prices_Asymmetric_Price_Transmission

Wu, F., Zhao, W. L., Ji, Q., & Zhang, D. (2020). Dependency, centrality and dynamic networks for international commodity futures prices. *International Review of*

Economics & Finance, *67*, 118–132. https://doi.org/10.1016/J.IREF.2020.01.004

Zapata, H. O., Betanco, J. E., Bampasidou, M., & Deliberto, M. (2023). A Cyclical Phenomenon among Stock & Commodity Markets. *Journal of Risk and Financial Management*, *16*(7), 320. https://doi.org/10.3390/JRFM16070320

A

Appendix 1

Introduction

1. Could you share some information about yourself, your role, and your responsibilities within the company?

General

1. What purposes do wood packaging materials serve within the company?
   (a) What are the benefits and drawbacks of this system?

2. Can you describe the typical packaging flow within the company?
   (a) Are there different types of flows?
   (b) What systems are used to manage the flow of wood packaging?
   (c) Does it differ between different types of packaging?

3. What types of wood packaging is currently used at the company (e.g., pallets, crates, etc.)?
   (a) What are the drawbacks of using wood as packaging material?
   (b) What are the benefits of using wood as packaging material?
   (c) What materials are the different types of wood packaging composed of (e.g., sawn timber, spruce, spine)?

4. How are the inventory levels of wood packaging monitored, and when is replenishment initiated?
   (a) Does it differ depending on the type of wood packaging?

5. How is the current sourcing process for wood packaging structured?
   (a) Is there any country where the majority of the suppliers are located?
   (b) What does the geographical distribution look like?
   (c) Are there any limitations when it comes to geographical markets for selecting wood packaging suppliers?

6. What requisites do the companies need to fulfil to be considered as a potential supplier?
   (a) What regulations and standards does the supplier need to follow?
   (b) Do the regulations and standards limit the suppliers available for selection?

7. What does the interaction between operations and purchasing look like?

B

Appendix 2

Introduction

1. Can you tell us a bit about yourself, your role and your responsibilities within the company?

Supply and Demand

1. How would you describe the impact of supply and demand on the Swedish wood industry?
2. What factors affect the supply of wood from Sweden today?
   (a) Is there room to increase the production of wood?
3. What factors affect the demand for wood from Sweden today?
   (a) Do you think the future demand for Swedish wood will increase or decrease, and why?
4. How do you see future trends in terms of supply and/or demand for Swedish wood, both nationally and internationally?
5. Are there any specific factors that could significantly affect the price of Swedish wood?
   (a) Short-term?
   (b) Long-term?

Macroeconomic Conditions

1. How do current macroeconomic conditions, such as inflation and interest rates, affect the wood industry in Sweden?
   (a) How does the economic situation, both nationally and globally, affect the price development of Swedish wood?
   (b) Is there any connection to growth rates?
   (c) Does it find it easy to pass on increases in costs to its customers?
2. How do exchange rates and international economic factors affect demand for Swedish wood?
3. Are there economic indicators that can be used to foresee changes in the wood market?

Competition and Market Integration

1. How would you describe the market structure for the Swedish wood industry today?
   (a) Are there any prominent players?
   (b) What does the current competitive situation look like?
   (c) Are there any challenges related to competition?
2. How is the Swedish wood industry and the Swedish wood prices affected by the fact that there are many small private owners of forest in Sweden?
3. How integrated is the Swedish wood market with the global and Nordic markets?
   (a) How does this affect the price of Swedish wood?
   (b) How does this affect the competitive situation?
4. Do you see any trends or changes in the competitive situation that may affect the Swedish wood market short-term or long-term?

Regulations

1. Can you name which regulations have the greatest impact on the Swedish wood industry?
2. How do Swedish and international regulations affect the wood industry, both in terms of production and trade?
   (a) What is the impact of EU regulations?
3. Are there lobbying organisations that aim to influence the design of regulations? How do they act?
4. Are there any potential changes to regulations that could potentially strengthen or weaken the Swedish wood industry?
5. How do you think the impact and development of new regulations will evolve in the future?

C

Appendix 3

The following information is gathered from interviews with market experts and information from Svenskt Trä (n.d.).
Roundwood refers to wood that has been harvested from trees and is still in its log form. The tree has not yet been processed into lumber, chips, or debarked. The roundwood is then sorted into different categories depending on its qualities, as seen in Figure C.2.
Sawlogs refers to the logs that are sorted into the category that will become sawn timber or veneer production.
Sawn timber, also called sawn wood or lumber, refers to wood that has been processed into pieces of planks, beams, and boards with defined dimensions. These are typically used in building structures, furniture, and packaging material.

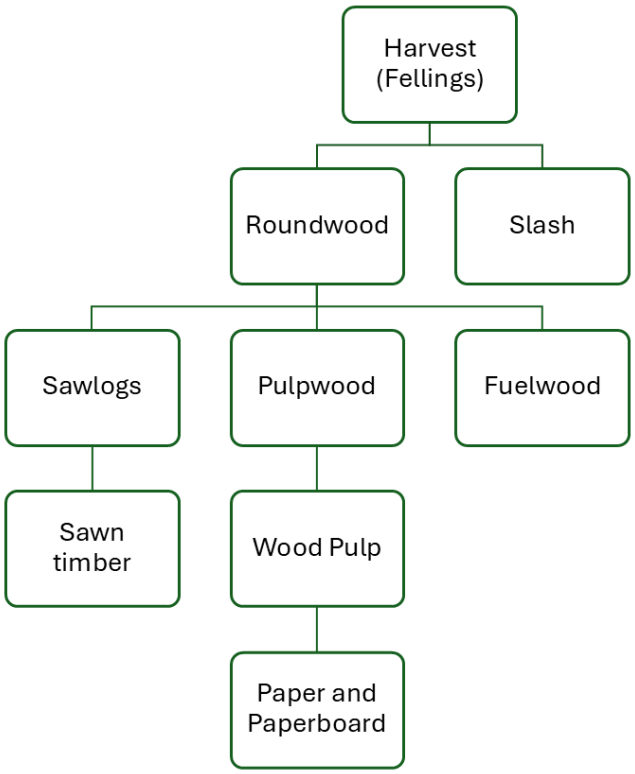

Figure C.1: Classification of different wood products

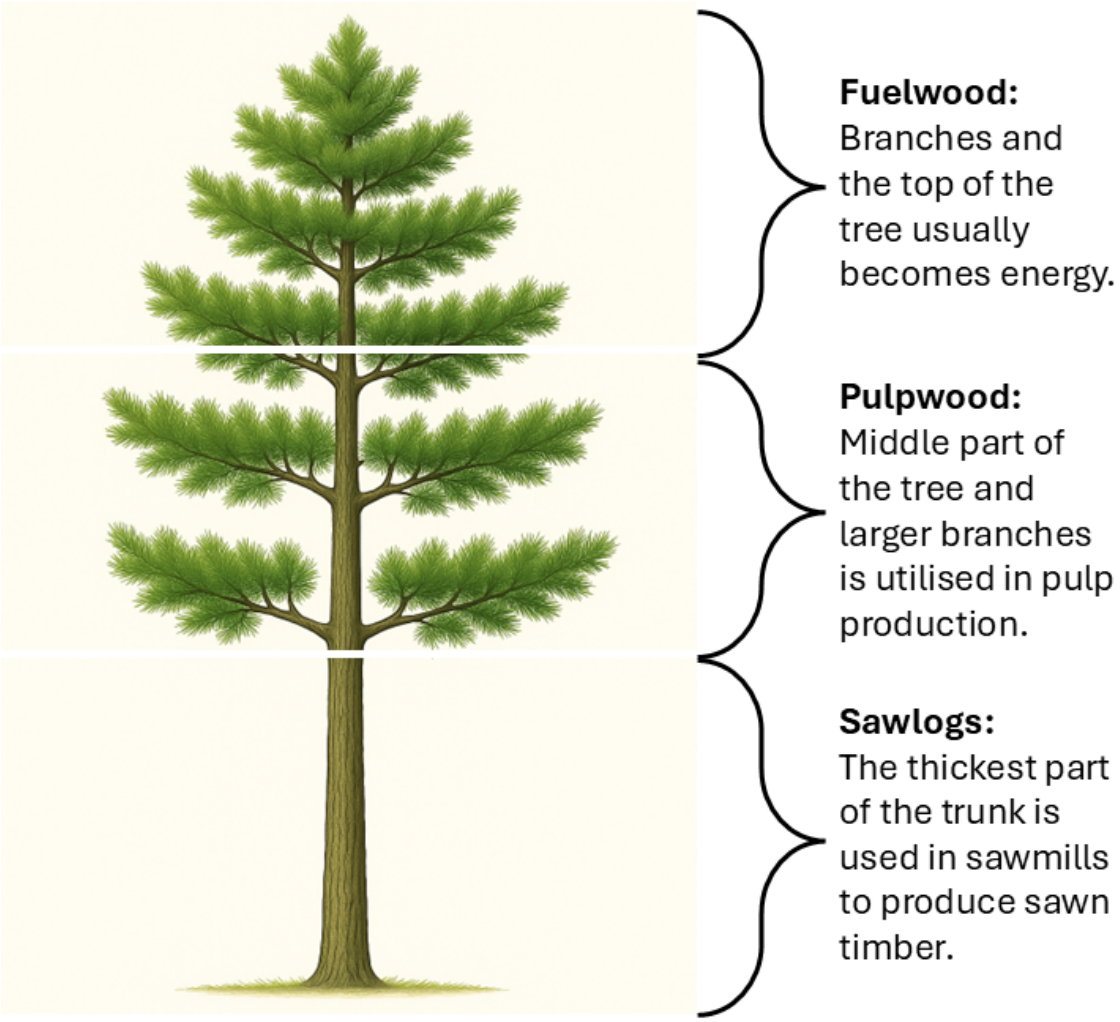

Figure C.2: Illustrations of what part of the tree is used in what assortment

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS
DIVISION OF SUPPLY AND OPERATIONS MANAGEMENT
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden
www.chalmers.se

CHALMERS
UNIVERSITY OF TECHNOLOGY