Norges Handelshøyskole

FIN11 Trading and Market Microstructure

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I am aware of what constitutes cheating and the consequences of cheating on an exam. I hereby declare that I will NOT cheat on this exam. *:	Yes

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Hedging the Wheat Market

How can Norgesmøllene hedge against international wheat price fluctuations, and how does this affect their costs?

FIN11 - Term Paper

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Abstract

This paper aims to look at hedging in the international wheat market from a Norwegian importer's point of view. To accomplish this, we will first look at the Norwegian and global wheat markets, as well as the Norwegian Agriculture Policy. The paper then discusses hedging strategies involving options, futures, and physical hedging and presents the underlying assumptions before applying the strategies and analysing the results.

The results show that during the 14-year period we analysed, the importer, Norgesmøllene AS, would have saved significant amounts of money by using the hedging strategies, compared to only buying in the spot market. All the proposed hedging strategies were effective during this period, with a varying degree of offsetting the price risks and cost savings.

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1 Introduction

"I'm bleeding. All my earned equity disappears when the wheat prices keep on raising. I can't go on making fixed price with customers without hedging against fluctuations in wheat prices."

– Alf Røren, CEO of Goman Valaker AS, 2022.

International wheat prices have experienced significant fluctuations during the last decades. Events like the financial crisis in 2008, the bad crop year in 2012, COVID-19, and the Russian invasion of Ukraine have all affected the prices. The increase of traders and speculators in the commodities markets have made the prices even more volatile. In this market, it is crucial for farmers, mills, and customers to secure predictable prices, thus making hedging in the commodities markets beneficial. This term paper aims to explore the highly relevant topic, by applying various hedging strategies from a Norwegian mill's perspective, Norgesmøllene AS. Due to the Norwegian Agriculture Policy, it is less common to hedge in the Norwegian domestic market. Therefore, we will focus on Norgesmøllene's imports and answer the following research question:

How can Norgesmøllene hedge against international wheat price fluctuations, and how does this affect their costs?

To get in-depth data about Norgesmøllene's imports, we contacted Roar Bjørkeli, Supply Chain Manager at Norgesmøllene. During our interview with him, 17.10.2022, he shared information on the firm's strategies regarding wheat imports and relevant data. To learn more about the Norwegian Agriculture Policy and price influencers in the market, we had a meeting with an advisor at the Norwegian Department of Agriculture, Andreas Moksnes, 07.11.2022. All our contacts gave permission to quote, and the paper will refer to the interviews for deeper insights.

2 The Wheat Market

When trying to understand how Norgesmøllene can hedge in the wheat market, it is necessary to have some knowledge about the company, the international wheat market, and Norwegian regulations. This section will give an overview before we move on to hedging theory and analysis.

2.1 Norgesmøllene AS

Norgesmøllene AS is the largest mill company in Norway, producing flour, oatmeal, healthy bars and cereal for large grocery companies like Norgesgruppen and Rema 1000, as well as for bakers around the country. Their total market share in Norway, including groceries, industries, and bakeries, is 61%. Yearly wheat consumption in Norway is approximately 270 000 tons, where Norgesmøllene serves around 160 000 tons to the Norwegian market (Bjørkeli, 2022). The company thus has an essential role in securing Norwegian citizens' access to food. Norwegian wheat production is insufficient; therefore, we depend on imports from international farmers to maintain our consumption. Due to large fluctuations in production outcome and wheat quality in Norway, the import share varies yearly, usually equalling between 20% to 80% of total consumption. Average wheat import in normal years constitutes 30% of total consumption, according to Roar Bjørkeli, Supply Chain Manager at Norgesmøllene AS.

Norgesmøllene's majority owner is Felleskjøpet Agri SA, a cooperation between Norwegian farmers to ensure adequate purchase and selling prices. Because of this ownership, Norgesmøllene AS is not profit-motivated when buying from the Norwegian farmers, but that does not mean they are not profit-motivated when buying from the international markets. On the contrary, they use international markets to make a profit. Since March 2020, international prices have been higher than domestic prices, and Norgesmøllene is losing on all imports, regardless of the wheat importance (Bjørkeli, 2022).

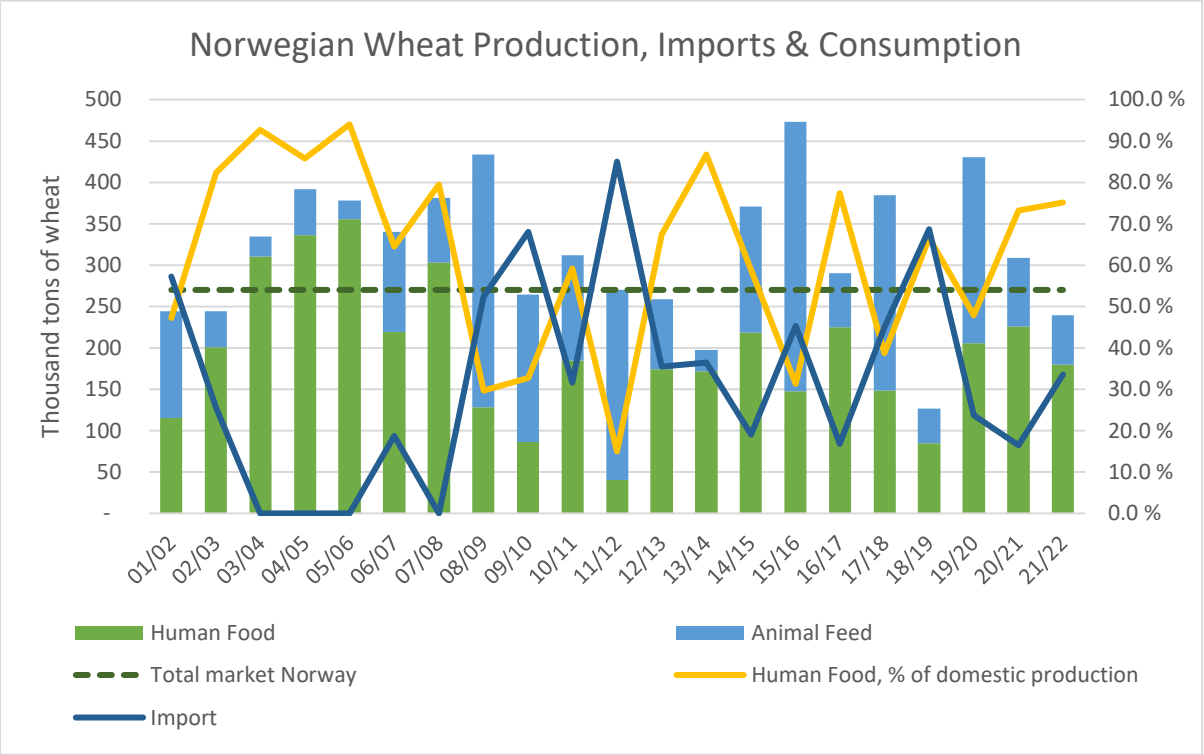


Figure 1: This graph shows yearly production from the Norwegian farmers, total wheat consumption in Norway, and how much of total consumption was imported from other countries. Source: (Bjørkeli, 2022), (Moksnes, 2022)

To prevent Norgesmøllene and other importers from profit-motivated trading in the international markets when there is wheat available in Norway, we have a Directorate of Agriculture that manages trading through a regulation called *Jordbruksoppgjøret*, The Norwegian Agriculture Policy.

2.2 The Norwegian Agriculture Policy

Various factors make producing wheat in Norway more expensive and strenuous than in other parts of the world. Some leading causes are the challenging topography and the rough climate, which make cultivating the land demanding. The rough conditions lead to a lower grain yield per hectare in Norway than in most European countries (Knutsen, 2020).

Therefore, Norway is dependent on having the opportunity to import wheat. However, it is still important to sustain some domestic production, primarily to ensure food security for the Norwegian people (Norwegian Government, 2015). To achieve this, there is an agriculture policy in place to provide market price support. This support mainly consists of high border protection and domestic market regulation. These agricultural subsidy measures differentiate

Norway significantly from other OECD countries, as the support is the highest among the countries and more than three times higher than the OECD average (OECD, 2021).

In order to balance the wheat import market, target prices are set by annual negotiations with the farmers. The Basic Agricultural Agreement (BAA) grants the mandate for these annual negotiations, which are held between the government and the national farmers' organizations. The market regulator for grains, primarily Norske Felleskjøpet SA, ensures that the target prices are reached in a balanced market (OECD, 2021).

Due to the heavily regulated domestic market, it is unnecessary to hedge against domestic price volatility. Therefore, we will focus on Norgesmøllene's opportunities to hedge against price fluctuations in their wheat imports.

2.3 The International Wheat Market

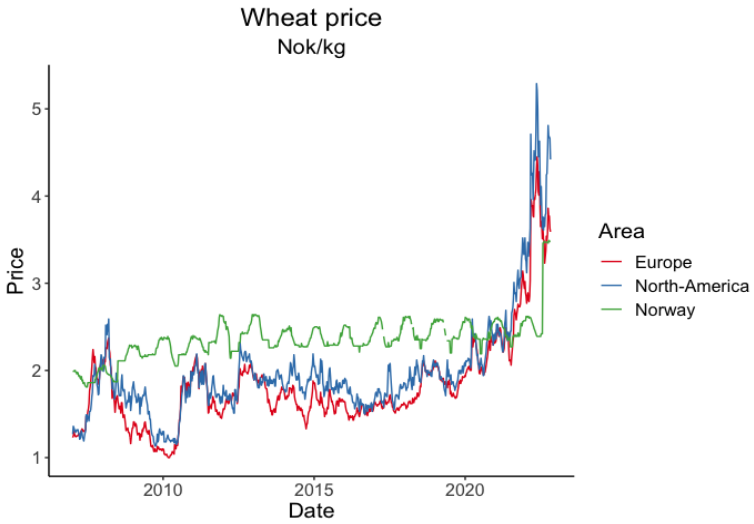


Figure 3 2 - Wheat Price. Source: (Landbruksdirektoratet).

Prices in the wheat market have varied substantially during the last years, as illustrated in Figure 3. The prices vary among other factors based on where the wheat originates from. We will look at the prices of European wheat of food quality because that is the kind that Norgesmøllene imports.

We will now look at which factors affect the prices. As with all other consumer goods, the price varies based on supply and demand (Pettinger, 2022). The demand has been increasing for a long time due to several factors. The first factor is population growth. As the total population on earth increases, so does the demand for wheat. Increasing wealth in the developing world has also led to increasing demand because people eat more wheat, as well as more meat, where wheat is crucial for animal feed. Another factor is the substitution effect. Wheat can, to some extent, be substituted with other sources of carbohydrates, such as rice, corn, and soy. The prices of these goods will affect the wheat demand.

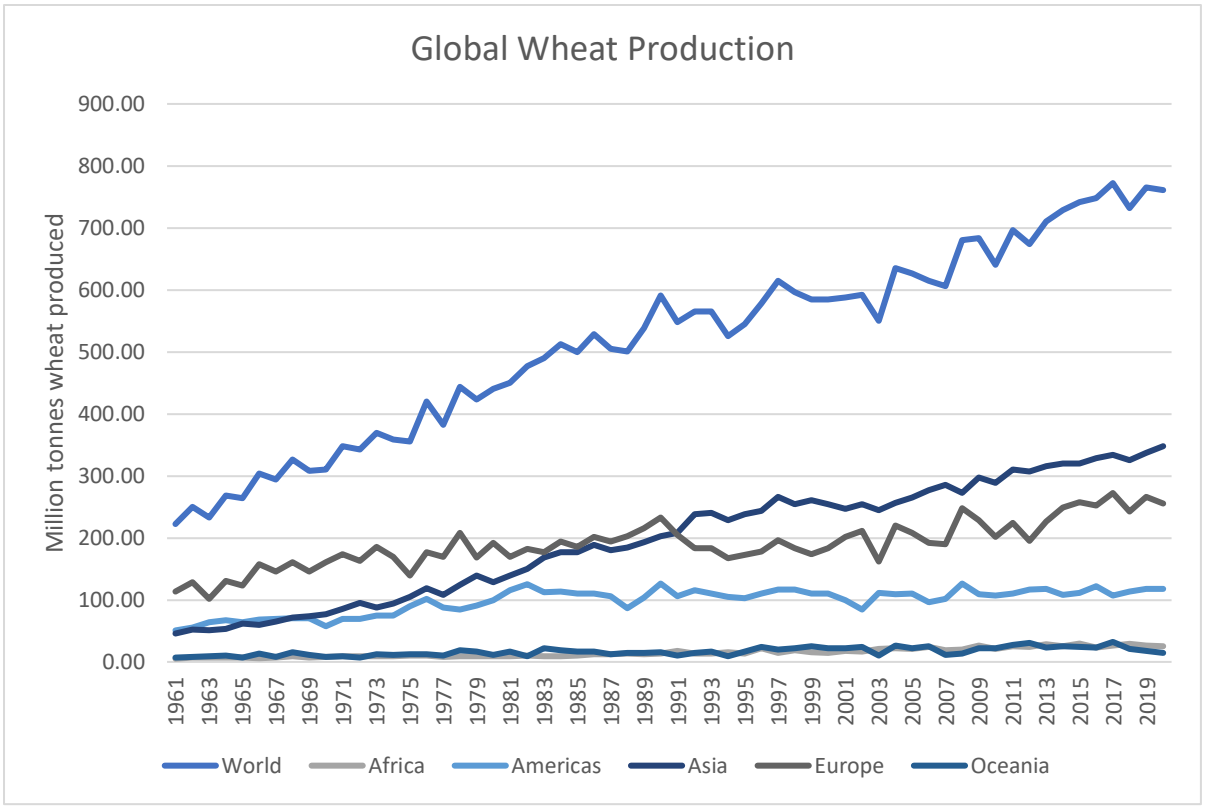


Figure 2 - Global production has been increasing steadily due to population growth (Pettinger, 2022). Source: (FAO, 2022)

The supply of wheat is unpredictable from year to year. The production is highly dependent on adequate weather conditions. In some years the price increases because bad weather lowers the crop yields. Historical evidence shows that the wheat price is also higher when the oil price is high (Pettinger, 2022). Furthermore, geo-political factors can also affect the wheat price. The most recent example of this is the war between Russia and Ukraine. With nearly a quarter of wheat export coming from those two countries, the war has led to a drastic reduction in supply, making the prices surge (Pettinger, 2022).

The final factor that affects the price is the finance market. Speculation in commodities among traders has become increasingly common. This affects the short-term price, making it more volatile (Moksnes, 2022).

All these factors have, in total, led to increasing wheat prices over time, especially in the last two years. Since there are so many factors affecting the wheat prices, making them volatile and exposed to major events, we will explore various hedging strategies for how Norgesmøllene can secure predictability and lower their costs.

3 Hedging

A hedge is an investment made to reduce the risk of adverse price movements in an asset (Scott, 2022). It works by holding an investment that will move in the opposite direction of the initial investment, so if the initial investment declines, the investment hedge will limit, or in the best case, offset the overall loss (Baker, 2022). With the intention to reduce financial risk, many different hedging techniques can be used. A popular strategy includes using derivatives such as options, which derive value from an underlying asset. Many also use short

selling to hedge their exposure to certain risks and less complex assets such as cash (Baker, 2022).

3.1 Why do we hedge?

Due to the variety of factors influencing the wheat price and the volatility caused by this, producers and buyers (in our case Norgesmøllene) can benefit from minimizing their risk exposure to the commodity spot price. We will now present two widely used hedging tools in the agricultural markets: O*ptions and futures*.

3.2 Options

Commodity option contracts are derivatives characterized in two ways: call and put options. A call option gives the right, but not the obligation, to buy an underlying asset at some point in the future at a pre-specific strike price. On the other hand, a put option gives the holder the right to sell the underlying asset at a predetermined price on or before the expiration date (Chen, 2022). In addition, the different types of options can be distinguished into two styles: American and European. The first is a version allowing the holder to exercise the option rights at any time before the expiration. European-style options, however, can only be exercised at the expiration date. (Majaski, 2022).

The price of options, also known as premiums, are constructed by two key components: sum of its intrinsic value and the time value. The intrinsic value of an option is the difference between its strike price and the current value of the underlying asset (Campbell, 2022). In other words, the value of an option if it were exercised today. The options time value revolves around the contract's extrinsic value, which is based on time until expiration and the expected volatility of the underlying asset's price (Ngubeni, u.d.). Meaning, the further away until an option expires and the higher the rate at which an asset fluctuates, the higher the premium. This is because of the greater probability that the option will be in the money, thus having intrinsic value.

3.2.1 The Black & Scholes model

To price the options, we use the Black & Scholes equation, explained in the appendix. The reason for choosing this formula is that it is highly acknowledged, as well as that the underlying assumptions are suitable for our purposes. The model assumes that the market is efficient, and thus that there are no arbitrage opportunities. Furthermore, it assumes that the commodities' price follows a Brownian motion, i.e., the price is random and not possible to consistently predict (Black & Scholes, 1973, p. 640). The risk-free rate and the option's volatility is known and constant, as well as that the option is "European", i.e., it can only be exercised at maturity. Lastly, the equation assumes that there are no transaction costs and no restrictions to short selling (Black & Scholes, 1973, p. 640).

3.2.2 Option strategies

There are several option strategies than can be used in hedging to both limit risk and maximize return. We will showcase this by first demonstrating a strategy that lowers the costs of using options, the collar strategy.

3.2.3 Collar Strategy

A collar option strategy can be implemented to reduce both positive and negative returns of an underlying asset (CFI, 2022). In the case of Norgesmøllene, they can create a collar by first purchasing a call option. The call option sets the upper limit for what they will pay for wheat, thus protecting them against continuing upward movement in the commodity spot price. To eliminate the cash requirement to pay for the call option, they can simultaneously write a put option with an offsetting premium. However, by doing so they obligate themselves to buy the commodity at the strike price should market fall (Lee, u.d.).

By combining these two option strategies, Norgesmøllene can create an upper and lower boundary for future prices. Using this strategy limits the downside opportunity of favourable prices, but in exchange for reducing upside risk (Lee, u.d.). The writing of the put option provides a premium, that ideally offsets the premiums paid to purchase the call option. However, this strategy is not always possible to execute, as the premiums of the puts and calls do not always match. When the entire cost of the call option is equal to the amount of selling the put option, it is referred to as a net-zero collar (CFI, 2022).

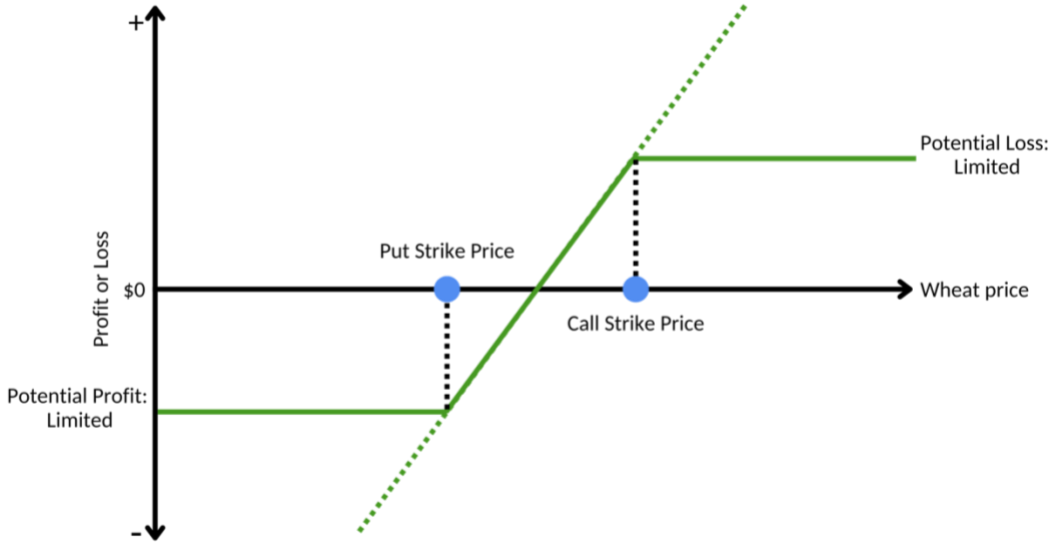


Figure 4 - Two-way collar strategy. Shows how the collar limits both the potential upside and downside.

3.3 Futures

Futures are financial derivative contracts between parties to buy or sell a specific asset at a predetermined price. They are standardized contracts that trade on an exchange with fixed maturity dates and uniform terms (Phung, 2021). One distinguishing feature of the future market is the daily market-to-market prices (CME , u.d.). The MTM process gives a more accurate appraisal of a financial asset based on the current market conditions (Tuovilia, 2022). In addition, the transactions are managed by clearing houses, which ensure that both the buyer

and seller honour their contractual obligations. By taking the opposite position in each trade, thus acting as the middleman in the transaction, the clearing houses improve the efficiency of the markets while drastically lowering the probability of default (CFA Institute , u.d.). Consequently, the future market is highly liquid, making it possible for buyers to exit and enter as they wish (Phung, 2021).

When Norgesmøllene uses future contracts as their hedging strategy, their initial goal is to reduce the likelihood that they will experience a loss due to unfavourable changes in the price of the underlying asset (Beers, 2021). By using futures contracts, they can lock in a more favourable price in advance. If Norgesmøllene knows they will purchase a commodity in the future, they can take a long position in a future contract. By doing so, they eliminate the possibility of loss from an adverse price change in the commodity, as well as limiting profits from a favourable price change.

3.3.1 Put-Call Parity

To price the futures, we use the put-call parity formula. It can be used to calculate the futures price because the formula shows the relationship between the futures price, call, put and strike (Klemkosky & Resnick, 1979). By rearranging the equation, we get

$$Futures\ price = Call\ price - Put\ price + Strike$$

Like in the Black & Scholes model, we assume there are no arbitrage opportunities when using the put-call parity formula, as the puts and calls have the same striking price, expiration date and, underlying futures contract (Klemkosky & Resnick, 1979). A drawback of this method, however, is that it heavily relies on our calculation of the option prices being correct.

3.4 Physical hedging

In addition to financial hedging, there is a physical opportunity while trading commodities like wheat, but it requires excellent storage volume and supervised silos in good condition. Since wheat consumption is almost constant throughout the year, and the harvesting goes on in August/September, it is necessary to have storage to keep food security for both humans and animals. Farmers, millers, animal feed producers, or specialized storage operators are typical storage parties – all parties who believe it is profitable, or less costly, to store.

Physical hedging is a possibility we have discussed with both the Supply Chain Manager at Norgesmøllene, Roar Bjørkeli, as well as the advisor at the Norwegian Department of Agriculture, Andreas Moksnes. Norgesmøllene has some excellent storage facilities, which are not used for physical hedging today. Andreas Moksnes is open to discussing physical hedging as a possibility but highlights the importance of having a Norwegian food production.

The agreed prices from The Norwegian Agriculture Policy are set in the Norwegian market to reflect the storage cost. Therefore, it is hard to make money on domestic storage sales. However, there is a possibility to profit from export if international prices are higher than domestic prices set in the Norwegian Agriculture Policy (Moksnes, 2022). Nevertheless, Norwegian farmers' possibility to export is minimal because of low production. Neither Norgesmøllene nor the Agricultural Department could say anything about our export possibilities.

Our possibility in physical hedging lays rather in procuring greater storage in Norway and importing when spot prices are low. Despite the inventory risk, physical hedging might be a great solution to make import profits and prevent a wheat shortage in the domestic market (Bjørkeli, 2022).

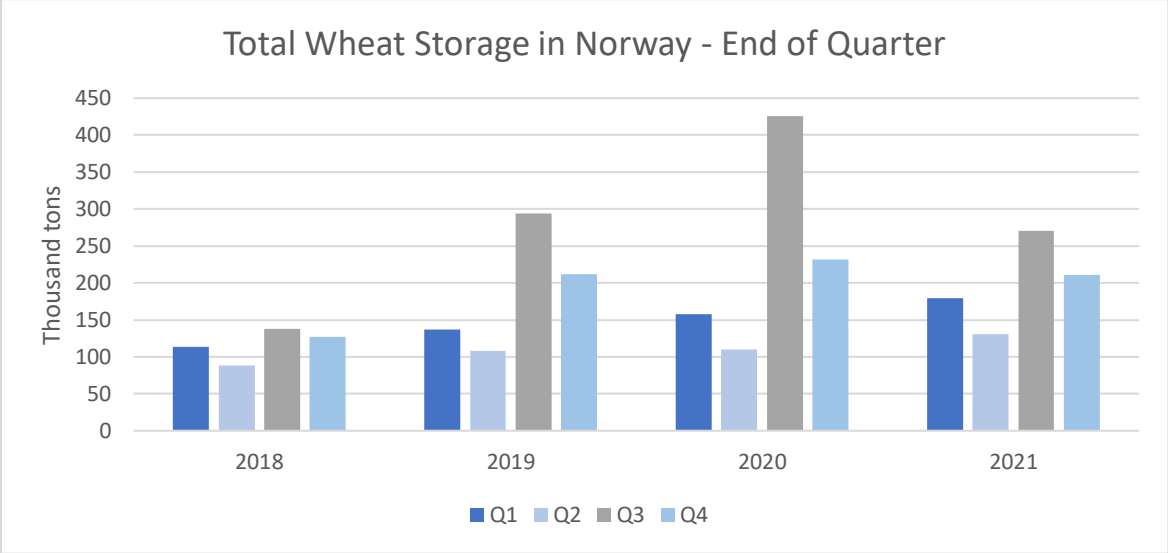


Figure 5: Total wheat storage in Norwegian silos at the end of each quarter. Includes storage at farms, in commercial silos, and emergency storage. Source: (Felleskjøpet, 2014)

Figure 5 shows that the quantity of wheat stored, varies throughout the year. From the end of May, the first winter wheat is harvested, but the actual harvesting volume appears throughout the summer months (U.S. Wheat Associates, 2021). By the end of Q3, storage volume reaches the top of the year, simultaneously as supply decreases through the next quarter until harvest in Q3 the year after. Harvesting once a year creates a spike in the supply that pushes prices down. Further on, the supply becomes increasingly limited while the demand, because of elasticity, stays almost the same (Fernando, 2021). Together this pushes the prices upwards and rewards the storage operators with higher prices, hopefully high enough to cover the storage costs.

In 2014 Felleskjøpet Agri, the majority owner of Norgesmøllene AS, bought Stavanger Havnesilo, Northern Europe's largest silo, with a storage capacity of 185 000 tons of wheat (Felleskjøpet, 2014). Stavanger Havnesilo is strategically placed due to shipping routes and is the most important import station for Norgesmøllene's international wheat in Norway. Every year Stavanger Havnesilo receives wheat from the international markets, ready to mill for Norgesmøllene or be used for animal feed. Since the silos are functional and large, they can import enormous volumes of wheat and secure future cash flows for Norgesmøllene.

Although physical hedging sounds profitable, the potential risk of loss arising is worth a second round in the risk management division. As shown in Figure 3, international prices are volatile and at times hard to predict throughout the year. A decline in wheat prices influences the value of inventories in their balance sheet and may cause losses for the storage operators.

4 Analysis

4.1 About the analysis

So far, we have presented relevant theory which will be used in our analysis. Further on, we will explain how we exercise our strategies and how Norgesmøllene can use them when importing wheat.

First, we will look at how they can use a two-way collar options strategy to secure better prices. Then we will implement a strategy using future contracts before we, at last, will look at if Norgesmøllene can use physical hedging to gain an advantage. We have chosen these strategies because futures and options are two prevalent and often effective ways to hedge in the commodities market. Physical hedging is not used by the mills today, so we want to examine if this is a possible option (Bjørkeli, 2022).

The price data we have used is collected from Landbruksdirektoratet, the official directorate of agriculture in Norway. All data and calculations are added to the appendix. We have used historical data dating back to the start of 2008, since this period captures major happenings and price movements in the market. All proposed strategies have a time interval of three months. This is because of the customs on the import of all agricultural products, which change every three months. Because of this, Norgesmøllene always uses a three-month time interval on their imports, according to Roar Bjørkeli (2022). We have chosen to use the same time period to make the analyses as realistic as possible.

4.1.1 Assumptions

In order to look at the sole effects of hedging with options and futures, we disregard variables such as costs of trading, transportation, storage, quality, and currency (thus disregarding the opportunity of Basis trading). This is because of the lack of precise data, making it difficult to produce accurate estimates of these costs. In the calculations, we have also not included customs duties, as they would be the same for all strategies and thus not affect the comparison of results from hedging with options and futures.

4.2 Options

4.2.1 Estimating the Volatility

Options use expected volatility rather than historical. However, since we do not have option prices, we use historical data to estimate the volatility and consequently calculate the prices. Using quarterly data, we calculate the standard deviation per quarter. After that, we annualize the standard deviation since the Black & Scholes model assumes constant volatility. The development of the annualized standard deviation based on historical wheat prices is shown below.

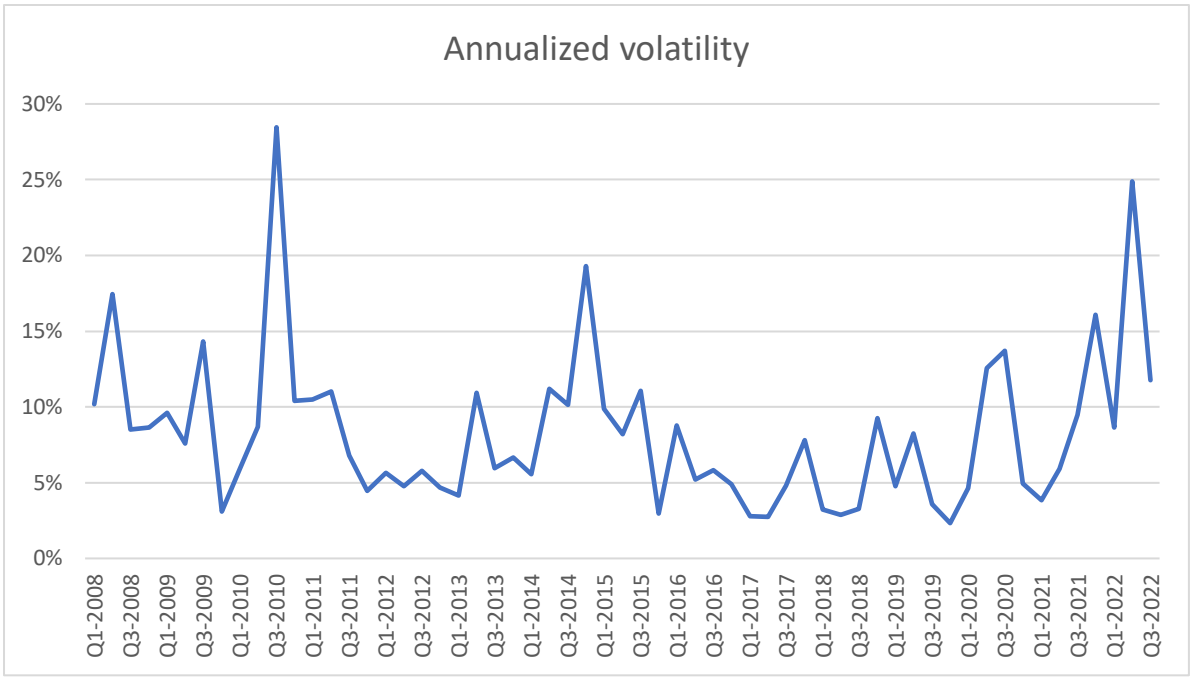


Figure 6 - Development of annualized volatility.

To calculate the option price for a quarter, we use the previous quarter's annualized standard deviation. When looking at the data in retrospect, we know the next quarter's volatility. However, if we were to calculate the following periods' option prices in real-time, we would not know the exact standard deviation of the next period. Therefore, the closest estimate we can obtain is the previous quarter's volatility.

4.2.2 Black & Scholes

Other parameters input in the Black & Scholes model are the risk-free rates, percentage strike-call increase, and strike-put reduction. The risk-free rate data is retrieved from the European Central Bank website (ECB, 2022). Due to macroeconomic variations throughout the 14 year-period, we use the applicable rate at the options' issue date to get realistic price estimates. The percentage increase/decrease relative to strike is set to 7,57%, calculated using the median of all annualized standard deviations throughout the timespan. This tells us how much the price most frequently deviated, with an equal probability of price fluctuations above or below 7,57%.

4.2.3 Results

Looking at the results from the analysis, we see that the two-way collar strategy performs well in some periods while it lacks performance in others. The difference in outcomes between this strategy and buying in the spot market is relatively small. The exception is in periods with sudden price changes. In these situations, when the average spot price exceeds the strike price on the call option, this strategy performs well.

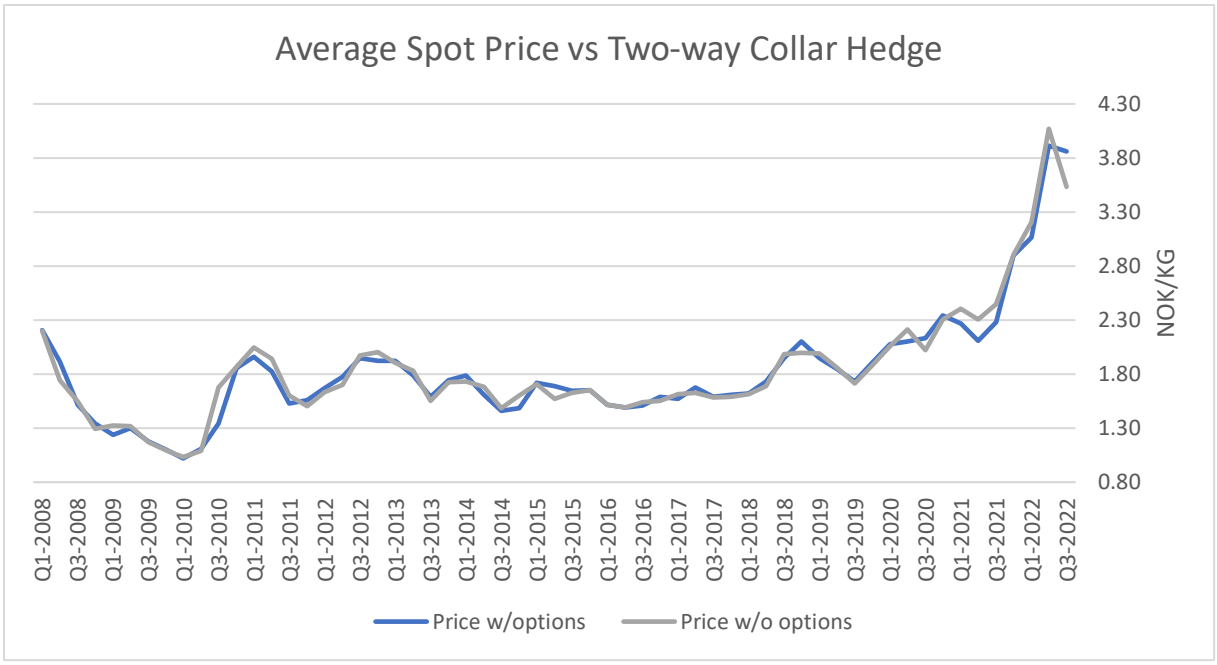


Figure 7 - Two-way collar strategy compared to three-month average spot price.

We can illustrate the effects by calculating the cost difference between the two scenarios in a theoretical example. Norgesmøllene has a market share of approximately 60%, which gives an estimated import quantity for the last period ranging between 60 000 to 220 000 tonnes per year. Using this import data, we can calculate what Norgesmøllene could have saved in total by applying the proposed two-way collar strategy on their imports.

When comparing the amount of money saved using the strategy, we see from figure 8 that it usually varies between +/- 4 MNOK and +/- 2 MNOK if they buy options for half of the import quantity. The results differ from quarter to quarter, and we see that the strategy does not guarantee any profit. When looking at the average price change and standard deviation of the price change, we see a difference between the strategies. While the average price changes are quite similar, the standard deviation is lower in both strategies involving options compared to the spot market. This is an important number to look at for Norgesmøllene, who has predictability as one of the main objectives behind using hedging.

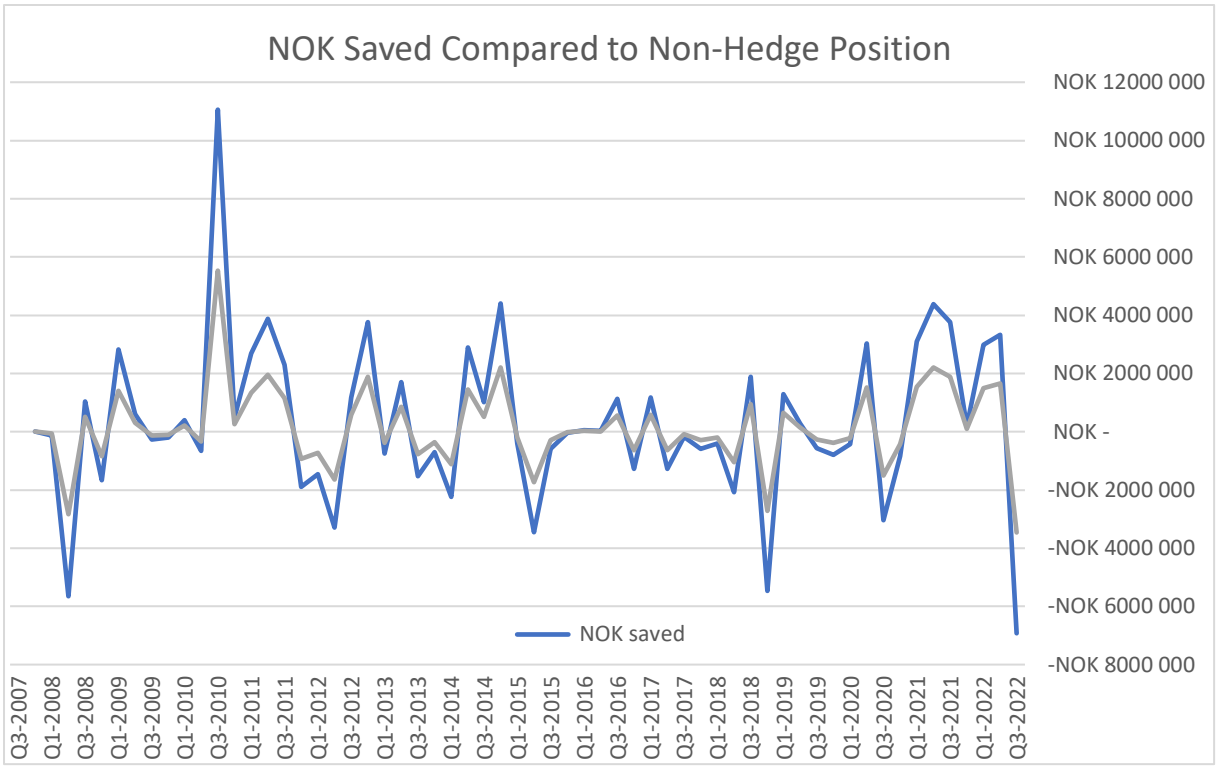


Figure 8 - Hedged position and 50/50 options and spot performance, compared to the average price on the spot market.

Table 1 - Options strategy performance

	w/Options	***50/50 Options and spot***	***w/o Options***
Maximum saved	*11 057 602*	*5 528 801*	
Maximum lost	*6 924 209*	*3 462 105*	
Average saved	*298 433*	*149 216*	
Total import (KG)	*2 021 331 614*	*2 021 331 614*	*2 021 331 614*
Total cost	*3 539 146 579*	*3 548 099 561*	*3 557 052 543*
Average % price change	*1,51%*	*1,42%*	*1,45%*
St. Dev % price change	*10,65%*	*10,51%*	*11,75%*
Total saved	**17 905 964**	**8 952 982**	

Looking at the total result of using the options strategy, we see that Norgesmøllene could have saved 17,9 MNOK over the 14 years. These savings come mainly in periods with price increases. The conclusion for this strategy is that it saves Norgesmøllene money when prices rise by setting a price roof. As prices have generally increased in the period we are looking at, the strategy has performed well. With this being said, it is no guarantee that this will be the case in the future.

An implication is also that the hedging strategies will only be advantageous if the profit is substantial enough to cover commission expenses and other trading costs. Another

implication is that the strategy only protects from price risk for three months. In a less regulated market than the Norwegian one, the hedging opportunities would be better.

4.3 Futures

4.3.1 Calculations

Moving on, we will apply the futures strategy on the wheat imports. We use the put-call parity equation to calculate futures prices within a three-month time period. The put, call, and strike prices are found using the Black-Scholes formula and can be seen in the appendix. We will compare these prices with the three-month average price in the spot market.

4.3.2 Results

When looking at the results, we see that the futures price and average price follow each other closely. Considering the short time horizon on the futures contracts, this makes sense. The first difference in prices we notice is that the futures strategy performs better in periods with increasing prices. This is because the price is already agreed upon, thus protecting Norgesmøllene from price increases during the three months. We see this clearly at the end of 2007, the end of 2010, and 2021-2022, with all three periods with rapid increases in wheat prices.

In the opposite situation, with decreasing prices, the futures strategy lacks performance. Buying futures is the same as securing a given price over a given period. As we see from the figure below, it takes more time for the futures price to decrease than for the spot price. In periods with decreasing prices, a future strategy does not perform well for buyers such as Norgesmøllene.

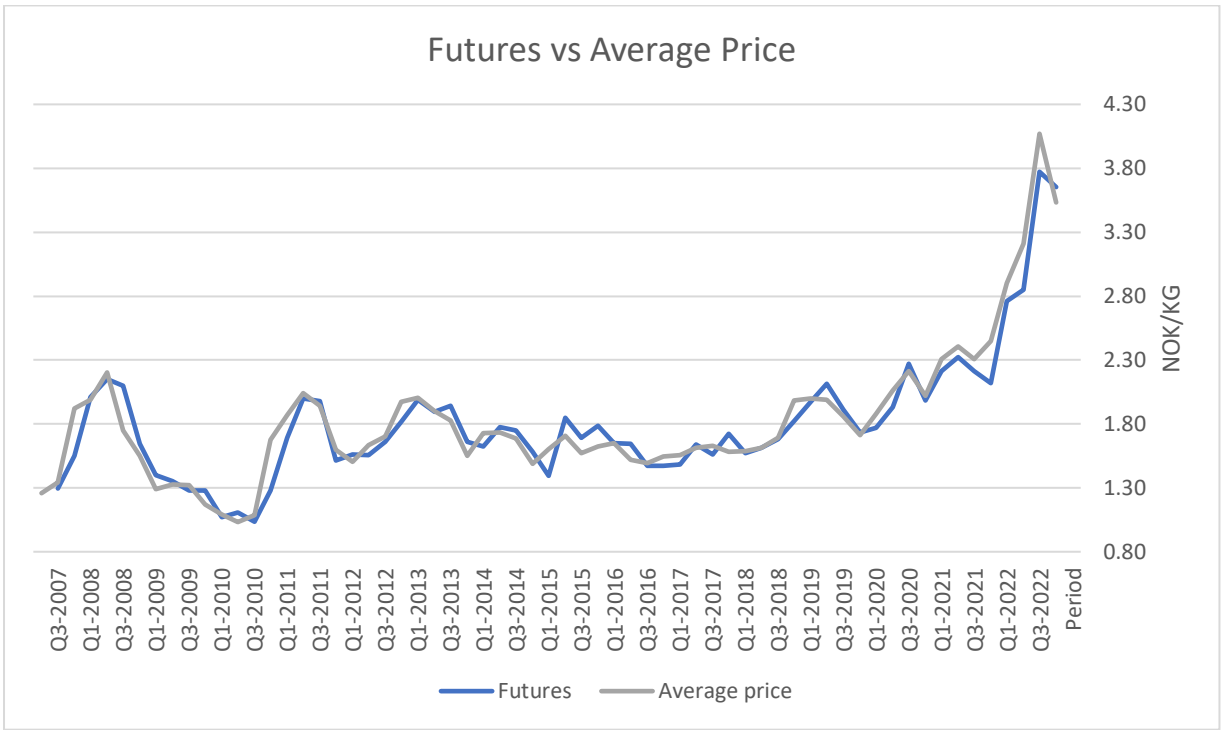


Figure 9 - Futures strategy price compared to three-month average spot price

Looking at the total performance over the 14 years, we see that the futures strategy would have saved Norgesmøllene over 39 MNOK. On average, this is about 2,5 MNOK a year, which is significant for a company with results ranging from 20-45 MNOK. The maximum amount they would have saved in a quarter during the period was 13 MNOK, while they would have lost 11,88 MNOK at the most. The average savings would have been 647 016 NOK per quarter. This is of course based on our presented assumptions, if these were changed, we could get favorable or unfavorable changes in the results.

We have also included a strategy where Norgesmøllene buys half of their import quantum with futures contracts and half on the spot market, equally spread out over the quarter. In this situation, they secure some of their import quantity while still being exposed to some price risk in the spot market. As we can see from the results in table 2, this makes potential profits and potential losses smaller. It halves the effect of price changes, thus halving the price risk. When we look at the average price change per quarter and the standard deviation of the change, we also see that a 50/50 strategy performs the best, implying that this strategy is not the most profitable but gives Norgesmøllene the most predictability and stability.

Table 2 - Futures strategy performance

	w/Futures	***50/50 Futures and Spot***	***w/o Futures***
Maximum saved	*13 005 760*	*6 502 880*	
Maximum lost	*11 888 809*	*5 944 404*	
Average saved	*647 016*	*323 508*	
Total import (KG)	*2 021 331 614*	*2 021 331 614*	*2 021 331 614*
Total cost	*3 583 526 365*	*3 603 260 355*	*3 622 994 345*
Average % price change	*2,44%*	*2,26%*	*2,32%*
St. Dev % price change	*12,57%*	*11,43%*	*12,65%*
Total saved	**39 467 980**	**19 733 990**	

The main objective for Norgesmøllene is to reduce the price risk, give security and predictability in the market, and get as low prices as possible. Over time, the futures strategy provides better prices than buying without hedging. This result, however, is just the case for the past and not necessarily the future, as past events cannot predict future events, given that the market is at least weak-form efficient (Harris, 2003). However, hedging with three-month futures contracts gives them predictability for the three upcoming months, which is valuable for an importer. A combination of futures and spot prices seems like a good strategy for Norgesmøllene, reducing the risks of buying all from the futures or the spot market.

A reason for the strategy's good performance might be the price rise over the period. When prices rise, it makes sense to secure a price in the future, to work against the increase. The result might have been quite different if the prices had decreased during the period.

4.4 Physical Hedging

To secure a client order, consumers and producers of wheat need to commit to a fixed price for their products, with delivery in the future. Usually, most producers and consumers aim to avoid large inventories, which means they want to produce or consume when it is closer to delivery time. However, this leaves them exposed to different risks.

The baker Goman Valaker AS, uses approximately 4000 tons of wheat from Norgesmøllene annually (Røren, 2022), with prices managed by the agricultural settlement and the Department of Agriculture. The bakers purchase may change considerably from the date they agreed on a fixed price until the date they actually buy wheat. If the price of wheat increases in this period, significant losses may occur for the company. But on the other hand, decreasing prices makes the deal even more profitable.

Roar Bjørkeli, the Supply Chain Manager at Norgesmøllene, presents two alternatives for hedging without bearing the price risk (Bjørkeli, 2022). However, risk related to inventory and performance is relevant to manage:

i) Create a fixed price agreement with a supplier for delivery in the future (like the futures contracts)
ii) Buy wheat from the spot market when the fixed-price agreement is signed

When creating a fixed price agreement with a supplier for delivery in the future, all price risk lays on the supplier. This may not be the best solution because physical suppliers charge a lot for bearing the price risk, usually more than the inventory cost of having the supply in storage silos.

Because of Norgesmøllene's position in Norwegian wheat supply and the importance of wheat for both humans and animals, they might be willing to take the inventory risk. Norgesmøllene has a vital role as the largest mill. Norwegian citizens depend on their supply, and the risk of not being able to supply the market is severe. Luckily, it has been low risk until now because of lower domestic prices in Norway than in the international markets.

At the beginning of January 2022, Norgesmøllene entered a fixed price agreement based exclusively on imports, approved by the Department of Agriculture. Norgesmøllene will produce 5000 tons of wheat flour for a bakery on 03.12.2022, and Bjørkeli is responsible for the purchasing. His issue is how to make the deal as profitable as possible for Norgesmøllene without knowing how the market will change in the future. Bjørkeli presented three possible alternatives: *a) Buy everything straight away, and take the inventory risk by storing it, b) distribute the purchases throughout the period, with less inventory risk, or c) wait until the day before and buy it from the spot market.*

In this case we disregard taxes and inventory risks, assuming taxes remains stable throughout the year and that the inventory risk is limited.

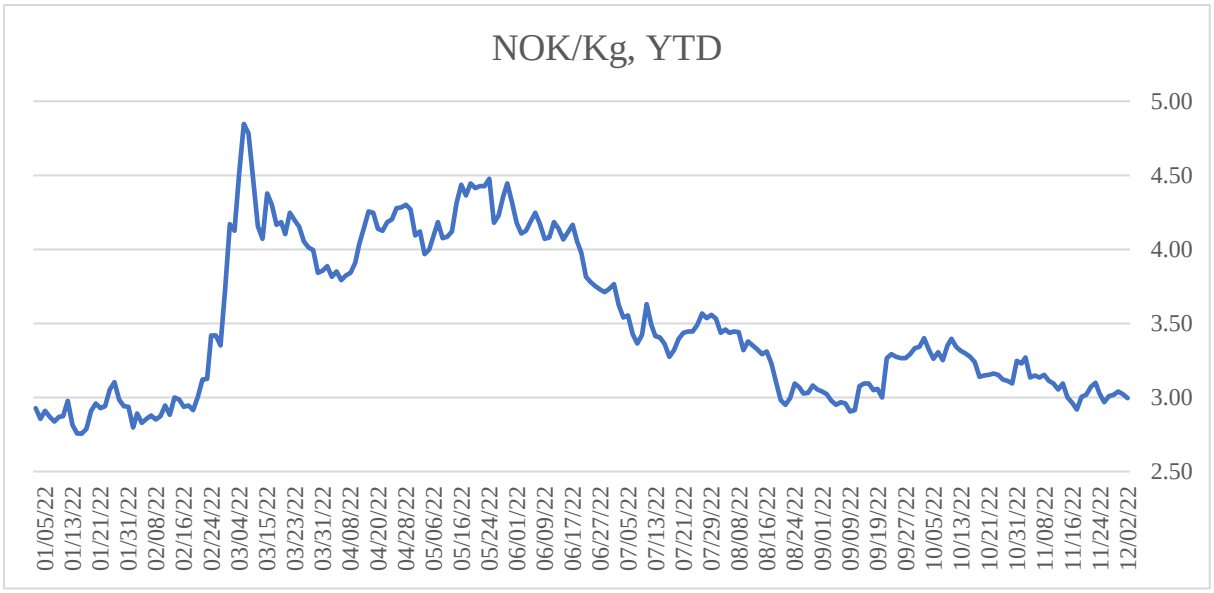


Figure 10 - Spot wheat prices YTD, NOK/Kg. Source: (FAO, 2022)

By studying the graph above, it is clear that the spot prices increased substantially due to the war in Ukraine. High volatility and political frictions make it harder to predict future prices, which is an argument to make spot market deals as fast as the agreement is signed. The transport costs reflect the rates in the spot market of Handymax shipping, starting the year very high because of Covid. The table below summarizes the calculation made to compare the different alternatives Bjørkeli presented.

Table 3 – Overview of calculations done in the different physical hedging alternatives

	a)	*b)*	*c)*
Spot price	*2,930*	*3,501*	*2,995*
Buy price	14 648 915	17 502 835	14 975 000
Storage cost	1 000 000	500 000	0
Transport cost	261 051	200 000	123 569
Total cost NOK:	***15 909 966***	***18 202 835***	***15 098 569***

This case proves that physical hedging can be both costly and cost-saving. In addition, the results show that the most important consideration is the spot price. Both storage and transport costs affect the result, but if the spot price varies like this year, it is more important to pay attention to variances and buy when prices are low. However, it is difficult to forecast this at the beginning of the year. According to Bjørkeli "Predictions are rarely perfect, and gut feeling from years of trading might help a bit" (Bjørkeli, 2022).

5 Limitations

Our analyses have some limitations that we will look at. Firstly, we have decided to use historical data when calculating the option and futures prices, as well as the physical hedging strategies. When calculating the prices, we would preferably use expected volatility instead of historical. However, we do not have the data to calculate this in our case, so we had to use historical prices. This gives us an estimate, but can also be a weakness in the analyses, as the data may vary from real-life results.

The results of all the proposed strategies are only as good as the assumptions they are based on. Another limitation might thus be the assumptions behind the Black & Scholes formula. We assume, for example, no transaction costs, which could influence our results if they were included. However, we have discussed and included the variables we found possible and relevant to incorporate into the analyses.

When it comes to physical hedging, there is no system for doing this today. The Department of Agriculture has not considered this a possibility yet, but they are planning to see if it is something they should facilitate. Therefore, large importers are not using this strategy today. We have not been able to obtain accurate storage costs from Felleskjøpet but we have estimated these based on available information.

6 Conclusion

Following the research question, this paper has looked at how a wheat importer like Norgesmøllene can use different hedging strategies to decrease their price risk and reduce costs when buying from the international market. The chosen time-period included both price declines and increases, making it possible to illustrate the strategies in a volatile market. Even with the regulations in the Norwegian agriculture market making it difficult to hedge for longer than three months, the strategies proved to be effective over the tested period. Our analyses show that both options and futures may secure lower costs in periods with rising wheat prices. Due to higher inventory risk, physical hedging is a riskier possibility than the other strategies. Nevertheless, physical hedging might be highly profitable when planned well and is a great way to secure wheat deliverance and predictability, which is valuable for a large importer like Norgesmøllene. Depending on Norgesmøllene's risk tolerance, our recommendation would be to consider implementing one, or a combination of the proposed hedging strategies.

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8 Other sources

Interview:

Name	**Company**	**Position**	**Date & location**
Alf Røren	Goman Valaker AS	CEO	14.10.2022, via telephone
Roar Bjørkeli	Norgesmøllene AS	Supply Chain Manager	17.10.2022, via Teams
Andreas Moksnes	The Norwegian Department of Agriculture	Advisor	07.11.2022, via Teams

9 Appendix

9.1 Volatility

Period	Average price	Std.dev.	Volatility	Annualized volatility
Q1-2008	2,20076923	0,11	5%	10%
Q2-2008	1,74692308	0,15	9%	17%
Q3-2008	1,54923077	0,07	4%	9%
Q4-2008	1,29153846	0,06	4%	9%
Q1-2009	1,32538462	0,06	5%	10%
Q2-2009	1,31846154	0,05	4%	8%
Q3-2009	1,16923077	0,08	7%	14%
Q4-2009	1,09384615	0,02	2%	3%
Q1-2010	1,03230769	0,03	3%	6%
Q2-2010	1,08846154	0,05	4%	9%
Q3-2010	1,67538462	0,24	14%	28%
Q4-2010	1,86714286	0,10	5%	10%
Q1-2011	2,04333333	0,11	5%	10%
Q2-2011	1,94076923	0,11	6%	11%
Q3-2011	1,59928571	0,05	3%	7%
Q4-2011	1,50307692	0,03	2%	4%
Q1-2012	1,63461538	0,05	3%	6%
Q2-2012	1,70153846	0,04	2%	5%
Q3-2012	1,97307692	0,06	3%	6%
Q4-2012	2,00384615	0,05	2%	5%
Q1-2013	1,90153846	0,04	2%	4%
Q2-2013	1,82846154	0,10	5%	11%
Q3-2013	1,55230769	0,05	3%	6%
Q4-2013	1,72538462	0,06	3%	7%
Q1-2014	1,73230769	0,05	3%	6%
Q2-2014	1,68461538	0,09	6%	11%
Q3-2014	1,48769231	0,08	5%	10%
Q4-2014	1,60153846	0,15	10%	19%
Q1-2015	1,70615385	0,08	5%	10%
Q2-2015	1,56923077	0,06	4%	8%
Q3-2015	1,62615385	0,09	6%	11%
Q4-2015	1,64846154	0,02	1%	3%
Q1-2016	1,51769231	0,07	4%	9%
Q2-2016	1,49076923	0,04	3%	5%
Q3-2016	1,54285714	0,04	3%	6%
Q4-2016	1,55461538	0,04	2%	5%
Q1-2017	1,61461538	0,02	1%	3%
Q2-2017	1,62923077	0,02	1%	3%
Q3-2017	1,58307692	0,04	2%	5%
Q4-2017	1,58769231	0,06	4%	8%
Q1-2018	1,61230769	0,03	2%	3%
Q2-2018	1,69153846	0,02	1%	3%
Q3-2018	1,98461538	0,03	2%	3%
Q4-2018	2	0,09	5%	9%
Q1-2019	1,99076923	0,05	2%	5%
Q2-2019	1,85923077	0,08	4%	8%
Q3-2019	1,71230769	0,03	2%	4%
Q4-2019	1,87923077	0,02	1%	2%
Q1-2020	2,06	0,05	2%	5%
Q2-2020	2,21384615	0,14	6%	13%
Q3-2020	2,01923077	0,14	7%	14%
Q4-2020	2,30846154	0,06	2%	5%
Q1-2021	2,40692308	0,05	2%	4%
Q2-2021	2,30461538	0,07	3%	6%
Q3-2021	2,44846154	0,12	5%	9%
Q4-2021	2,90357143	0,23	8%	16%
Q1-2022	3,2075	0,14	4%	9%
Q2-2022	4,07	0,51	12%	25%
Q3-2022	3,53571429	0,21	6%	12%

Where $Annualized\ volatility = \sigma \cdot \sqrt{4}$, because there are 4 periods per year.

9.2 Black & Scholes formula

$$C = SN(d_1) - Ke^{-rt}N(d_2)$$

Where:

$$d_1 = \frac{ln\frac{S}{K} + \left(r + \frac{\sigma_v^2}{2}\right)t}{\sigma_s\sqrt{t}}$$

$$d_2 = d_1 - \sigma_s\sqrt{t}$$

And where:

$C = Call\ option$

$S = Current\ underlying\ price$

$K = Strike\ price$

$r = Risk\ free\ rate$

$t = Time\ to\ maturity$

$N = A\ normal\ distribution$

9.3 Options

Data used in the two-way collar options strategy.

Quarter	Current Price	St.dev (t-1)	% volatility	Rate	CallStrike	PutStrike	Time	D1	N(D1)
Q3-2022	NOK 3,65	0,4154	11,75%	0,25%	kr 3,93	kr 3,37	0,25	-1,2021	0,1147
Q2-2022	NOK 3,77	1,0124	24,88%	0,25%	kr 4,06	kr 3,48	0,25	-0,5194	0,3017
Q1-2022	NOK 2,85	0,2776	8,65%	0,25%	kr 3,07	kr 2,63	0,25	-1,6500	0,0495
Q4-2021	NOK 2,76	0,4668	16,08%	0,25%	kr 2,97	kr 2,55	0,25	-0,8598	0,1950
Q3-2021	NOK 2,12	0,2317	9,46%	0,25%	kr 2,28	kr 1,96	0,25	-1,5050	0,0662
Q2-2021	NOK 2,21	0,1366	5,93%	0,25%	kr 2,38	kr 2,04	0,25	-2,4255	0,0076
Q1-2021	NOK 2,32	0,0921	3,83%	0,25%	kr 2,50	kr 2,14	0,25	-3,7714	0,0001
Q4-2020	NOK 2,21	0,1143	4,95%	0,25%	kr 2,38	kr 2,04	0,25	-2,9085	0,0018
Q3-2020	NOK 1,98	0,2765	13,69%	0,25%	kr 2,13	kr 1,83	0,25	-1,0223	0,1533
Q2-2020	NOK 2,27	0,2783	12,57%	0,25%	kr 2,44	kr 2,10	0,25	-1,1193	0,1315
Q1-2020	NOK 1,93	0,0959	4,66%	0,25%	kr 2,08	kr 1,78	0,25	-3,0961	0,0010
Q4-2019	NOK 1,77	0,0438	2,33%	0,25%	kr 1,90	kr 1,64	0,25	-6,2037	0,0000
Q3-2019	NOK 1,73	0,0610	3,56%	0,25%	kr 1,86	kr 1,60	0,25	-4,0525	0,0000
Q2-2019	NOK 1,91	0,1536	8,26%	0,25%	kr 2,05	kr 1,77	0,25	-1,7304	0,0418
Q1-2019	NOK 2,11	0,0951	4,78%	0,25%	kr 2,27	kr 1,95	0,25	-3,0164	0,0013
Q4-2018	NOK 1,97	0,1847	9,24%	0,25%	kr 2,12	kr 1,82	0,25	-1,5432	0,0614
Q3-2018	NOK 1,82	0,0646	3,26%	0,25%	kr 1,96	kr 1,68	0,25	-4,4356	0,0000
Q2-2018	NOK 1,68	0,0485	2,86%	0,25%	kr 1,81	kr 1,55	0,25	-5,0435	0,0000
Q1-2018	NOK 1,61	0,0521	3,23%	0,25%	kr 1,73	kr 1,49	0,25	-4,4670	0,0000
Q4-2017	NOK 1,57	0,1236	7,79%	0,25%	kr 1,69	kr 1,45	0,25	-1,8385	0,0330
Q3-2017	NOK 1,72	0,0762	4,82%	0,25%	kr 1,85	kr 1,59	0,25	-2,9920	0,0014
Q2-2017	NOK 1,56	0,0448	2,75%	0,25%	kr 1,68	kr 1,44	0,25	-5,2546	0,0000
Q1-2017	NOK 1,64	0,0448	2,77%	0,25%	kr 1,76	kr 1,52	0,25	-5,2074	0,0000
Q4-2016	NOK 1,48	0,0763	4,91%	0,25%	kr 1,59	kr 1,37	0,25	-2,9354	0,0017
Q3-2016	NOK 1,47	0,0899	5,83%	0,25%	kr 1,58	kr 1,36	0,25	-2,4685	0,0068
Q2-2016	NOK 1,47	0,0774	5,19%	0,25%	kr 1,58	kr 1,36	0,25	-2,7720	0,0028
Q1-2016	NOK 1,64	0,1334	8,79%	0,30%	kr 1,76	kr 1,52	0,25	-1,6213	0,0525
Q4-2015	NOK 1,65	0,0489	2,97%	0,30%	kr 1,77	kr 1,53	0,25	-4,8622	0,0000
Q3-2015	NOK 1,78	0,1800	11,07%	0,30%	kr 1,91	kr 1,65	0,25	-1,2771	0,1008
Q2-2015	NOK 1,69	0,1290	8,22%	0,30%	kr 1,82	kr 1,56	0,25	-1,7362	0,0413
Q1-2015	NOK 1,86	0,1685	9,88%	0,30%	kr 2,00	kr 1,72	0,25	-1,4375	0,0753
Q4-2014	NOK 1,38	0,3087	19,28%	0,30%	kr 1,48	kr 1,28	0,25	-0,7010	0,2416
Q3-2014	NOK 1,58	0,1505	10,12%	0,40%	kr 1,70	kr 1,46	0,25	-1,3973	0,0812
Q2-2014	NOK 1,74	0,1889	11,21%	0,75%	kr 1,87	kr 1,61	0,25	-1,2402	0,1075
Q1-2014	NOK 1,77	0,0964	5,57%	0,75%	kr 1,90	kr 1,64	0,25	-2,5399	0,0055
Q4-2013	NOK 1,62	0,1152	6,68%	1,00%	kr 1,74	kr 1,50	0,25	-2,0943	0,0181
Q3-2013	NOK 1,66	0,0925	5,96%	1,00%	kr 1,79	kr 1,53	0,25	-2,3492	0,0094
Q2-2013	NOK 1,93	0,2000	10,94%	1,50%	kr 2,08	kr 1,78	0,25	-1,2384	0,1078
Q1-2013	NOK 1,89	0,0788	4,14%	1,50%	kr 2,03	kr 1,75	0,25	-3,3311	0,0004
Q4-2012	NOK 1,98	0,0933	4,66%	1,50%	kr 2,13	kr 1,83	0,25	-2,9606	0,0015
Q3-2012	NOK 1,81	0,1138	5,77%	1,75%	kr 1,95	kr 1,67	0,25	-2,3644	0,0090
Q2-2012	NOK 1,65	0,0811	4,77%	1,75%	kr 1,77	kr 1,53	0,25	-2,8667	0,0021
Q1-2012	NOK 1,55	0,0920	5,63%	1,75%	kr 1,67	kr 1,43	0,25	-2,4226	0,0077
Q4-2011	NOK 1,55	0,0667	4,44%	2,25%	kr 1,67	kr 1,43	0,25	-3,0220	0,0013
Q3-2011	NOK 1,51	0,1086	6,79%	2,00%	kr 1,62	kr 1,40	0,25	-1,9844	0,0236
Q2-2011	NOK 1,97	0,2142	11,04%	1,75%	kr 2,12	kr 1,82	0,25	-1,2154	0,1121
Q1-2011	NOK 1,99	0,2144	10,49%	1,75%	kr 2,14	kr 1,84	0,25	-1,2813	0,1000
Q4-2010	NOK 1,72	0,1946	10,42%	1,75%	kr 1,85	kr 1,59	0,25	-1,2904	0,0984
Q3-2010	NOK 1,24	0,4768	28,46%	1,75%	kr 1,33	kr 1,15	0,25	-0,4109	0,3406
Q2-2010	NOK 1,03	0,0944	8,67%	1,75%	kr 1,11	kr 0,95	0,25	-1,5599	0,0594
Q1-2010	NOK 1,10	0,0608	5,89%	1,75%	kr 1,18	kr 1,02	0,25	-2,3128	0,0104
Q4-2009	NOK 1,07	0,0338	3,09%	1,75%	kr 1,15	kr 0,99	0,25	-4,4349	0,0000
Q3-2009	NOK 1,27	0,1674	14,32%	1,75%	kr 1,37	kr 1,17	0,25	-0,9223	0,1782
Q2-2009	NOK 1,27	0,0998	7,57%	2,50%	kr 1,37	kr 1,17	0,25	-1,7439	0,0406
Q1-2009	NOK 1,34	0,1271	9,59%	3,00%	kr 1,44	kr 1,24	0,25	-1,3411	0,0899
Q4-2008	NOK 1,38	0,1117	8,65%	5,25%	kr 1,48	kr 1,28	0,25	-1,3619	0,0866
Q3-2008	NOK 1,64	0,1321	8,53%	5,00%	kr 1,76	kr 1,52	0,25	-1,3972	0,0812
Q2-2008	NOK 2,06	0,3046	17,43%	5,00%	kr 2,22	kr 1,90	0,25	-0,6500	0,2578
Q1-2008	NOK 2,12	0,2244	10,20%	5,00%	kr 2,28	kr 1,96	0,25	-1,1604	0,1229

N(-D1)	D2	N(D2)	N(-D2)	e^-rt	Call Option premium	Put option premium
0,8853	-1,2608	0,1037	0,8963	0,9994	NOK 0,0117	kr 0,0084
0,6983	-0,6438	0,2598	0,7402	0,9994	NOK 0,0844	kr 0,0714
0,9505	-1,6933	0,0452	0,9548	0,9994	NOK 0,0025	kr 0,0016
0,8050	-0,9401	0,1736	0,8264	0,9994	NOK 0,0231	kr 0,0182
0,9338	-1,5523	0,0603	0,9397	0,9994	NOK 0,0029	kr 0,0019
0,9924	-2,4551	0,0070	0,9930	0,9994	NOK 0,0002	kr 0,0001
0,9999	-3,7905	0,0001	0,9999	0,9994	NOK 0,0000	kr 0,0000
0,9982	-2,9333	0,0017	0,9983	0,9994	NOK 0,0000	kr 0,0000
0,8467	-1,0907	0,1377	0,8623	0,9994	NOK 0,0105	kr 0,0079
0,8685	-1,1822	0,1186	0,8814	0,9994	NOK 0,0092	kr 0,0068
0,9990	-3,1193	0,0009	0,9991	0,9994	NOK 0,0000	kr 0,0000
1,0000	-6,2154	0,0000	1,0000	0,9994	NOK 0,0000	kr 0,0000
1,0000	-4,0703	0,0000	1,0000	0,9994	NOK 0,0000	kr 0,0000
0,9582	-1,7717	0,0382	0,9618	0,9994	NOK 0,0013	kr 0,0008
0,9987	-3,0402	0,0012	0,9988	0,9994	NOK 0,0000	kr 0,0000
0,9386	-1,5894	0,0560	0,9440	0,9994	NOK 0,0024	kr 0,0015
1,0000	-4,4519	0,0000	1,0000	0,9994	NOK 0,0000	kr 0,0000
1,0000	-5,0578	0,0000	1,0000	0,9994	NOK 0,0000	kr 0,0000
1,0000	-4,4832	0,0000	1,0000	0,9994	NOK 0,0000	kr 0,0000
0,9670	-1,8774	0,0302	0,9698	0,9994	NOK 0,0008	kr 0,0005
0,9986	-3,0161	0,0013	0,9987	0,9994	NOK 0,0000	kr 0,0000
1,0000	-5,2684	0,0000	1,0000	0,9994	NOK 0,0000	kr 0,0000
1,0000	-5,2212	0,0000	1,0000	0,9994	NOK 0,0000	kr 0,0000
0,9983	-2,9599	0,0015	0,9985	0,9994	NOK 0,0000	kr 0,0000
0,9932	-2,4976	0,0063	0,9937	0,9994	NOK 0,0001	kr 0,0000
0,9972	-2,7980	0,0026	0,9974	0,9994	NOK 0,0000	kr 0,0000
0,9475	-1,6652	0,0479	0,9521	0,9993	NOK 0,0016	kr 0,0010
1,0000	-4,8770	0,0000	1,0000	0,9993	NOK 0,0000	kr 0,0000
0,8992	-1,3324	0,0914	0,9086	0,9993	NOK 0,0046	kr 0,0032
0,9587	-1,7773	0,0378	0,9622	0,9993	NOK 0,0011	kr 0,0007
0,9247	-1,4869	0,0685	0,9315	0,9993	NOK 0,0030	kr 0,0020
0,7584	-0,7974	0,2126	0,7874	0,9993	NOK 0,0181	kr 0,0147
0,9188	-1,4479	0,0738	0,9262	0,9990	NOK 0,0029	kr 0,0019
0,8925	-1,2963	0,0974	0,9026	0,9981	NOK 0,0049	kr 0,0032
0,9945	-2,5677	0,0051	0,9949	0,9981	NOK 0,0001	kr 0,0000
0,9819	-2,1276	0,0167	0,9833	0,9975	NOK 0,0004	kr 0,0001
0,9906	-2,3790	0,0087	0,9913	0,9975	NOK 0,0002	kr 0,0000
0,8922	-1,2931	0,0980	0,9020	0,9963	NOK 0,0053	kr 0,0029
0,9996	-3,3518	0,0004	0,9996	0,9963	NOK 0,0000	kr 0,0000
0,9985	-2,9839	0,0014	0,9986	0,9963	NOK 0,0000	kr 0,0000
0,9910	-2,3932	0,0084	0,9916	0,9956	NOK 0,0002	kr 0,0000
0,9979	-2,8905	0,0019	0,9981	0,9956	NOK 0,0000	kr 0,0000
0,9923	-2,4508	0,0071	0,9929	0,9956	NOK 0,0001	kr 0,0000
0,9987	-3,0442	0,0012	0,9988	0,9944	NOK 0,0000	kr 0,0000
0,9764	-2,0184	0,0218	0,9782	0,9950	NOK 0,0004	kr 0,0001
0,8879	-1,2706	0,1019	0,8981	0,9956	NOK 0,0058	kr 0,0030
0,9000	-1,3338	0,0911	0,9089	0,9956	NOK 0,0048	kr 0,0024
0,9016	-1,3425	0,0897	0,9103	0,9956	NOK 0,0041	kr 0,0020
0,6594	-0,5532	0,2901	0,7099	0,9956	NOK 0,0371	kr 0,0293
0,9406	-1,6032	0,0544	0,9456	0,9956	NOK 0,0011	kr 0,0005
0,9896	-2,3423	0,0096	0,9904	0,9956	NOK 0,0001	kr 0,0000
1,0000	-4,4503	0,0000	1,0000	0,9956	NOK 0,0000	kr 0,0000
0,8218	-0,9939	0,1601	0,8399	0,9956	NOK 0,0085	kr 0,0053
0,9594	-1,7817	0,0374	0,9626	0,9938	NOK 0,0008	kr 0,0002
0,9101	-1,3890	0,0824	0,9176	0,9925	NOK 0,0026	kr 0,0009
0,9134	-1,4051	0,0800	0,9200	0,9870	NOK 0,0023	kr 0,0003
0,9188	-1,4398	0,0750	0,9250	0,9876	NOK 0,0025	kr 0,0004
0,7422	-0,7372	0,2305	0,7695	0,9876	NOK 0,0267	kr 0,0131
0,8771	-1,2114	0,1129	0,8871	0,9876	NOK 0,0064	kr 0,0015

Quarter	Call premium	Put premium	Collar cost	StrikeCall	StrikePut	Spotprice	Average price	Price w/options	Price w/o options
Q3-2022	-NOK 0,0117	NOK 0,008	-NOK 0,003	NOK 3,926	NOK 3,374	NOK 3,86	NOK 3,54	kr 3,86	kr 3,54
Q2-2022	-NOK 0,0844	NOK 0,071	-NOK 0,013	NOK 4,055	NOK 3,485	NOK 3,90	NOK 4,07	kr 3,91	kr 4,07
Q1-2022	-NOK 0,0025	NOK 0,002	-NOK 0,001	NOK 3,066	NOK 2,634	NOK 3,89	NOK 3,21	kr 3,07	kr 3,21
Q4-2021	-NOK 0,0231	NOK 0,018	-NOK 0,005	NOK 2,969	NOK 2,551	NOK 2,89	NOK 2,90	kr 2,89	kr 2,90
Q3-2021	-NOK 0,0029	NOK 0,002	-NOK 0,001	NOK 2,280	NOK 1,960	NOK 2,69	NOK 2,45	kr 2,28	kr 2,45
Q2-2021	-NOK 0,0002	NOK 0,000	-NOK 0,000	NOK 2,377	NOK 2,043	NOK 2,11	NOK 2,30	kr 2,11	kr 2,30
Q1-2021	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 2,496	NOK 2,144	NOK 2,27	NOK 2,41	kr 2,27	kr 2,41
Q4-2020	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 2,377	NOK 2,043	NOK 2,34	NOK 2,31	kr 2,34	kr 2,31
Q3-2020	-NOK 0,0105	NOK 0,008	-NOK 0,003	NOK 2,130	NOK 1,830	NOK 2,15	NOK 2,02	kr 2,13	kr 2,02
Q2-2020	-NOK 0,0092	NOK 0,007	-NOK 0,002	NOK 2,442	NOK 2,098	NOK 1,96	NOK 2,21	kr 2,10	kr 2,21
Q1-2020	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 2,076	NOK 1,784	NOK 2,43	NOK 2,06	kr 2,08	kr 2,06
Q4-2019	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,904	NOK 1,636	NOK 1,94	NOK 1,88	kr 1,90	kr 1,88
Q3-2019	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,861	NOK 1,599	NOK 1,73	NOK 1,71	kr 1,73	kr 1,71
Q2-2019	-NOK 0,0013	NOK 0,001	-NOK 0,001	NOK 2,055	NOK 1,765	NOK 1,85	NOK 1,86	kr 1,85	kr 1,86
Q1-2019	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 2,270	NOK 1,950	NOK 1,87	NOK 1,99	kr 1,95	kr 1,99
Q4-2018	-NOK 0,0024	NOK 0,002	-NOK 0,001	NOK 2,119	NOK 1,821	NOK 2,10	NOK 2,00	kr 2,10	kr 2,00
Q3-2018	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,958	NOK 1,682	NOK 1,95	NOK 1,98	kr 1,95	kr 1,98
Q2-2018	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,807	NOK 1,553	NOK 1,73	NOK 1,69	kr 1,73	kr 1,69
Q1-2018	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,732	NOK 1,488	NOK 1,62	NOK 1,61	kr 1,62	kr 1,61
Q4-2017	-NOK 0,0008	NOK 0,000	-NOK 0,000	NOK 1,689	NOK 1,451	NOK 1,61	NOK 1,59	kr 1,61	kr 1,59
Q3-2017	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,850	NOK 1,590	NOK 1,57	NOK 1,58	kr 1,59	kr 1,58
Q2-2017	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,678	NOK 1,442	NOK 1,70	NOK 1,63	kr 1,68	kr 1,63
Q1-2017	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,764	NOK 1,516	NOK 1,57	NOK 1,61	kr 1,57	kr 1,61
Q4-2016	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,592	NOK 1,368	NOK 1,63	NOK 1,55	kr 1,59	kr 1,55
Q3-2016	-NOK 0,0001	NOK 0,000	-NOK 0,000	NOK 1,581	NOK 1,359	NOK 1,51	NOK 1,54	kr 1,51	kr 1,54
Q2-2016	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,581	NOK 1,359	NOK 1,49	NOK 1,49	kr 1,49	kr 1,49
Q1-2016	-NOK 0,0016	NOK 0,001	-NOK 0,001	NOK 1,764	NOK 1,516	NOK 1,46	NOK 1,52	kr 1,52	kr 1,52
Q4-2015	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,775	NOK 1,525	NOK 1,65	NOK 1,65	kr 1,65	kr 1,65
Q3-2015	-NOK 0,0046	NOK 0,003	-NOK 0,001	NOK 1,915	NOK 1,645	NOK 1,61	NOK 1,63	kr 1,65	kr 1,63
Q2-2015	-NOK 0,0011	NOK 0,001	-NOK 0,000	NOK 1,818	NOK 1,562	NOK 1,69	NOK 1,57	kr 1,69	kr 1,57
Q1-2015	-NOK 0,0030	NOK 0,002	-NOK 0,001	NOK 2,001	NOK 1,719	NOK 1,63	NOK 1,71	kr 1,72	kr 1,71
Q4-2014	-NOK 0,0181	NOK 0,015	-NOK 0,003	NOK 1,484	NOK 1,276	NOK 1,85	NOK 1,60	kr 1,49	kr 1,60
Q3-2014	-NOK 0,0029	NOK 0,002	-NOK 0,001	NOK 1,700	NOK 1,460	NOK 1,33	NOK 1,49	kr 1,46	kr 1,49
Q2-2014	-NOK 0,0049	NOK 0,003	-NOK 0,002	NOK 1,872	NOK 1,608	NOK 1,59	NOK 1,68	kr 1,61	kr 1,68
Q1-2014	-NOK 0,0001	NOK 0,000	-NOK 0,000	NOK 1,904	NOK 1,636	NOK 1,79	NOK 1,73	kr 1,79	kr 1,73
Q4-2013	-NOK 0,0004	NOK 0,000	-NOK 0,000	NOK 1,743	NOK 1,497	NOK 1,78	NOK 1,73	kr 1,74	kr 1,73
Q3-2013	-NOK 0,0002	NOK 0,000	-NOK 0,000	NOK 1,786	NOK 1,534	NOK 1,59	NOK 1,55	kr 1,59	kr 1,55
Q2-2013	-NOK 0,0053	NOK 0,003	-NOK 0,002	NOK 2,076	NOK 1,784	NOK 1,67	NOK 1,83	kr 1,79	kr 1,83
Q1-2013	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 2,033	NOK 1,747	NOK 1,92	NOK 1,90	kr 1,92	kr 1,90
Q4-2012	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 2,130	NOK 1,830	NOK 1,92	NOK 2,00	kr 1,92	kr 2,00
Q3-2012	-NOK 0,0002	NOK 0,000	-NOK 0,000	NOK 1,947	NOK 1,673	NOK 1,98	NOK 1,97	kr 1,95	kr 1,97
Q2-2012	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,775	NOK 1,525	NOK 1,78	NOK 1,70	kr 1,77	kr 1,70
Q1-2012	-NOK 0,0001	NOK 0,000	-NOK 0,000	NOK 1,667	NOK 1,433	NOK 1,69	NOK 1,63	kr 1,67	kr 1,63
Q4-2011	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,667	NOK 1,433	NOK 1,56	NOK 1,50	kr 1,56	kr 1,50
Q3-2011	-NOK 0,0004	NOK 0,000	-NOK 0,000	NOK 1,624	NOK 1,396	NOK 1,53	NOK 1,60	kr 1,53	kr 1,60
Q2-2011	-NOK 0,0058	NOK 0,003	-NOK 0,003	NOK 2,119	NOK 1,821	NOK 1,68	NOK 1,94	kr 1,82	kr 1,94
Q1-2011	-NOK 0,0048	NOK 0,002	-NOK 0,002	NOK 2,141	NOK 1,839	NOK 1,96	NOK 2,04	kr 1,96	kr 2,04
Q4-2010	-NOK 0,0041	NOK 0,002	-NOK 0,002	NOK 1,850	NOK 1,590	NOK 2,04	NOK 1,87	kr 1,85	kr 1,87
Q3-2010	-NOK 0,0371	NOK 0,029	-NOK 0,008	NOK 1,334	NOK 1,146	NOK 1,85	NOK 1,68	kr 1,34	kr 1,68
Q2-2010	-NOK 0,0011	NOK 0,000	-NOK 0,001	NOK 1,108	NOK 0,952	NOK 1,14	NOK 1,09	kr 1,11	kr 1,09
Q1-2010	-NOK 0,0001	NOK 0,000	-NOK 0,000	NOK 1,183	NOK 1,017	NOK 1,02	NOK 1,03	kr 1,02	kr 1,03
Q4-2009	-NOK 0,0000	NOK 0,000	-NOK 0,000	NOK 1,151	NOK 0,989	NOK 1,10	NOK 1,09	kr 1,10	kr 1,09
Q3-2009	-NOK 0,0085	NOK 0,005	-NOK 0,003	NOK 1,366	NOK 1,174	NOK 1,10	NOK 1,17	kr 1,18	kr 1,17
Q2-2009	-NOK 0,0008	NOK 0,000	-NOK 0,001	NOK 1,366	NOK 1,174	NOK 1,30	NOK 1,32	kr 1,30	kr 1,32
Q1-2009	-NOK 0,0026	NOK 0,001	-NOK 0,002	NOK 1,441	NOK 1,239	NOK 1,20	NOK 1,33	kr 1,24	kr 1,33
Q4-2008	-NOK 0,0023	NOK 0,000	-NOK 0,002	NOK 1,484	NOK 1,276	NOK 1,34	NOK 1,29	kr 1,34	kr 1,29
Q3-2008	-NOK 0,0025	NOK 0,000	-NOK 0,002	NOK 1,764	NOK 1,516	NOK 1,44	NOK 1,55	kr 1,52	kr 1,55
Q2-2008	-NOK 0,0267	NOK 0,013	-NOK 0,014	NOK 2,216	NOK 1,904	NOK 1,71	NOK 1,75	kr 1,92	kr 1,75
Q1-2008	-NOK 0,0064	NOK 0,002	-NOK 0,005	NOK 2,280	NOK 1,960	NOK 2,20	NOK 2,20	kr 2,20	kr 2,20

KG import	NOK w/o options		NOK w/options		Difference		NOK with 50/50		Difference	
21 139 049	NOK	74 741 639	NOK	81 665 848	-NOK	6 924 209	NOK	78 203 743	-NOK	3 462 105
21 139 049	NOK	86 035 931	NOK	82 717 720	NOK	3 318 211	NOK	84 376 825	NOK	1 659 105
21 139 049	NOK	67 803 501	NOK	64 826 597	NOK	2 976 904	NOK	66 315 049	NOK	1 488 452
22 554 750	NOK	65 489 328	NOK	65 293 566	NOK	195 762	NOK	65 391 447	NOK	97 881
22 554 750	NOK	55 224 438	NOK	51 457 698	NOK	3 766 740	NOK	53 341 068	NOK	1 883 370
22 554 750	NOK	51 980 024	NOK	47 592 585	NOK	4 387 439	NOK	49 786 304	NOK	2 193 720
22 554 750	NOK	54 287 548	NOK	51 199 298	NOK	3 088 250	NOK	52 743 423	NOK	1 544 125
26 804 690	NOK	61 877 595	NOK	62 723 483	-NOK	845 887	NOK	62 300 539	-NOK	422 944
26 804 690	NOK	54 124 854	NOK	57 158 979	-NOK	3 034 125	NOK	55 641 917	-NOK	1 517 062
26 804 690	NOK	59 341 459	NOK	56 305 532	NOK	3 035 927	NOK	57 823 496	NOK	1 517 964
26 804 690	NOK	55 217 661	NOK	55 649 121	-NOK	431 460	NOK	55 433 391	-NOK	215 730
31 828 105	NOK	59 812 353	NOK	60 599 980	-NOK	787 626	NOK	60 206 167	-NOK	393 813
31 828 105	NOK	54 499 508	NOK	55 062 625	-NOK	563 117	NOK	54 781 067	-NOK	281 559
31 828 105	NOK	59 175 791	NOK	58 898 694	NOK	277 098	NOK	59 037 242	NOK	138 549
31 828 105	NOK	63 362 411	NOK	62 074 341	NOK	1 288 070	NOK	62 718 376	NOK	644 035
54 169 478	NOK	108 338 956	NOK	113 801 486	-NOK	5 462 530	NOK	111 070 221	-NOK	2 731 265
54 169 478	NOK	107 505 579	NOK	105 630 483	NOK	1 875 096	NOK	106 568 031	NOK	937 548
54 169 478	NOK	91 629 755	NOK	93 713 197	-NOK	2 083 442	NOK	92 671 476	-NOK	1 041 721
54 169 478	NOK	87 337 866	NOK	87 754 555	-NOK	416 689	NOK	87 546 210	-NOK	208 345
26 247 857	NOK	41 673 521	NOK	42 267 715	-NOK	594 194	NOK	41 970 618	-NOK	297 097
26 247 857	NOK	41 552 377	NOK	41 729 332	-NOK	176 956	NOK	41 640 854	-NOK	88 478
26 247 857	NOK	42 763 816	NOK	44 046 042	-NOK	1 282 226	NOK	43 404 929	-NOK	641 113
26 247 857	NOK	42 380 194	NOK	41 209 135	NOK	1 171 058	NOK	41 794 665	NOK	585 529
34 416 353	NOK	53 504 192	NOK	54 792 127	-NOK	1 287 935	NOK	54 148 160	-NOK	643 967
34 416 353	NOK	53 099 516	NOK	51 970 529	NOK	1 128 987	NOK	52 535 023	NOK	564 494
34 416 353	NOK	51 306 840	NOK	51 281 059	NOK	25 782	NOK	51 293 950	NOK	12 891
34 416 353	NOK	52 233 435	NOK	52 191 072	NOK	42 363	NOK	52 212 253	NOK	21 182
28 572 380	NOK	47 100 469	NOK	47 144 427	-NOK	43 958	NOK	47 122 448	-NOK	21 979
28 572 380	NOK	46 463 086	NOK	47 049 030	-NOK	585 944	NOK	46 756 058	-NOK	292 972
28 572 380	NOK	44 836 658	NOK	48 300 705	-NOK	3 464 047	NOK	46 568 682	-NOK	1 732 024
28 572 380	NOK	48 748 876	NOK	49 151 406	-NOK	402 530	NOK	48 950 141	-NOK	201 265
38 741 979	NOK	62 046 769	NOK	57 642 284	NOK	4 404 485	NOK	59 844 526	NOK	2 202 243
38 741 979	NOK	57 636 144	NOK	56 617 713	NOK	1 018 431	NOK	57 126 928	NOK	509 216
38 741 979	NOK	65 265 333	NOK	62 376 679	NOK	2 888 654	NOK	63 821 006	NOK	1 444 327
38 741 979	NOK	67 113 028	NOK	69 350 483	-NOK	2 237 455	NOK	68 231 755	-NOK	1 118 727
40 551 334	NOK	69 966 648	NOK	70 674 757	-NOK	708 109	NOK	70 320 702	-NOK	354 055
40 551 334	NOK	62 948 148	NOK	64 481 034	-NOK	1 532 886	NOK	63 714 591	-NOK	766 443
40 551 334	NOK	74 146 555	NOK	72 438 658	NOK	1 707 896	NOK	73 292 606	NOK	853 948
40 551 334	NOK	77 109 921	NOK	77 858 728	-NOK	748 807	NOK	77 484 325	-NOK	374 403
44 761 210	NOK	89 694 579	NOK	85 942 326	NOK	3 752 253	NOK	87 818 452	NOK	1 876 127
44 761 210	NOK	88 317 311	NOK	87 156 005	NOK	1 161 306	NOK	87 736 658	NOK	580 653
44 761 210	NOK	76 162 921	NOK	79 447 354	-NOK	3 284 433	NOK	77 805 137	-NOK	1 642 217
44 761 210	NOK	73 167 363	NOK	74 635 534	-NOK	1 468 171	NOK	73 901 449	-NOK	734 086
33 136 584	NOK	49 806 834	NOK	51 693 453	-NOK	1 886 618	NOK	50 750 144	-NOK	943 309
33 136 584	NOK	52 994 865	NOK	50 710 204	NOK	2 284 661	NOK	51 852 535	NOK	1 142 331
33 136 584	NOK	64 310 462	NOK	60 429 248	NOK	3 881 214	NOK	62 369 855	NOK	1 940 607
33 136 584	NOK	67 709 086	NOK	65 027 963	NOK	2 681 123	NOK	66 368 525	NOK	1 340 562
33 136 584	NOK	61 870 736	NOK	61 377 078	NOK	493 657	NOK	61 623 907	NOK	246 829
33 136 584	NOK	55 516 523	NOK	44 458 921	NOK	11 057 602	NOK	49 987 722	NOK	5 528 801
33 136 584	NOK	36 067 897	NOK	36 736 257	-NOK	668 360	NOK	36 402 077	-NOK	334 180
33 136 584	NOK	34 207 150	NOK	33 802 334	NOK	404 816	NOK	34 004 742	NOK	202 408
33 136 584	NOK	36 246 325	NOK	36 450 243	-NOK	203 918	NOK	36 348 284	-NOK	101 959
33 136 584	NOK	38 744 313	NOK	39 003 467	-NOK	259 154	NOK	38 873 890	-NOK	129 577
33 136 584	NOK	43 689 311	NOK	43 096 799	NOK	592 513	NOK	43 393 055	NOK	296 256
33 136 584	NOK	43 918 718	NOK	41 099 809	NOK	2 818 910	NOK	42 509 264	NOK	1 409 455
33 136 584	NOK	42 797 173	NOK	44 469 043	-NOK	1 671 870	NOK	43 633 108	-NOK	835 935
33 136 584	NOK	51 336 215	NOK	50 301 736	NOK	1 034 479	NOK	50 818 976	NOK	517 240
33 136 584	NOK	57 887 063	NOK	63 546 698	-NOK	5 659 635	NOK	60 716 881	-NOK	2 829 818
33 136 584	NOK	72 925 974	NOK	73 063 406	-NOK	137 432	NOK	72 994 690	-NOK	68 716

9.4 Futures

Data used in the futures hedging strategy.

Period	Strike	Call	Put	Futures price	Average price	Change w/hedge	Change w/o hedge
Q3-2022	3,93	0,011685	0,330262	kr 3,61	kr 3,54	0,5%	-13,1%
Q2-2022	4,06	0,084395	0,551204	kr 3,59	kr 4,07	26,4%	26,9%
Q1-2022	3,07	0,002504	0,229556	kr 2,84	kr 3,21	4,0%	10,5%
Q4-2021	2,97	0,023093	0,261537	kr 2,73	kr 2,90	28,9%	18,6%
Q3-2021	2,28	0,002854	0,165502	kr 2,12	kr 2,45	-4,2%	6,2%
Q2-2021	2,38	0,000164	0,166279	kr 2,21	kr 2,30	-4,8%	-4,3%
Q1-2021	2,50	8,49E-07	0,174062	kr 2,32	kr 2,41	5,0%	4,3%
Q4-2020	2,38	2,86E-05	0,165916	kr 2,21	kr 2,31	11,6%	14,3%
Q3-2020	2,13	0,010501	0,159353	kr 1,98	kr 2,02	-12,7%	-8,8%
Q2-2020	2,44	0,009172	0,182941	kr 2,27	kr 2,21	17,4%	7,5%
Q1-2020	2,08	1,21E-05	0,144808	kr 1,93	kr 2,06	9,0%	9,6%
Q4-2019	1,90	8,72E-13	0,132787	kr 1,77	kr 1,88	2,3%	9,7%
Q3-2019	1,86	1,74E-07	0,129787	kr 1,73	kr 1,71	-9,4%	-7,9%
Q2-2019	2,05	0,001319	0,144167	kr 1,91	kr 1,86	-9,5%	-6,6%
Q1-2019	2,27	1,81E-05	0,158312	kr 2,11	kr 1,99	7,1%	-0,5%
Q4-2018	2,12	0,002372	0,150164	kr 1,97	kr 2,00	8,2%	0,8%
Q3-2018	1,96	2,8E-08	0,136538	kr 1,82	kr 1,98	8,3%	17,3%
Q2-2018	1,81	1,02E-09	0,126036	kr 1,68	kr 1,69	4,3%	4,9%
Q1-2018	1,73	2,12E-08	0,120784	kr 1,61	kr 1,61	2,5%	1,6%
Q4-2017	1,69	0,000781	0,117947	kr 1,57	kr 1,59	-8,7%	0,3%
Q3-2017	1,85	1,62E-05	0,129037	kr 1,72	kr 1,58	10,3%	-2,8%
Q2-2017	1,68	2,83E-10	0,117033	kr 1,56	kr 1,63	-4,9%	0,9%
Q1-2017	1,76	3,91E-10	0,123035	kr 1,64	kr 1,61	10,8%	3,9%
Q4-2016	1,59	1,73E-05	0,111037	kr 1,48	kr 1,55	0,7%	0,8%
Q3-2016	1,58	9,38E-05	0,110282	kr 1,47	kr 1,54	0,0%	3,5%
Q2-2016	1,58	3,17E-05	0,110552	kr 1,47	kr 1,49	-10,5%	-1,8%
Q1-2016	1,76	0,001567	0,122814	kr 1,64	kr 1,52	-0,4%	-7,9%
Q4-2015	1,77	2,71E-09	0,125332	kr 1,65	kr 1,65	-7,6%	1,4%
Q3-2015	1,91	0,004602	0,133559	kr 1,79	kr 1,63	5,6%	3,6%
Q2-2015	1,82	0,001145	0,127863	kr 1,69	kr 1,57	-8,6%	-8,0%
Q1-2015	2,00	0,00304	0,153279	kr 1,85	kr 1,71	32,3%	6,5%
Q4-2014	1,48	0,0181	0,10391	kr 1,40	kr 1,60	-11,6%	7,7%
Q3-2014	1,70	0,00289	0,12004	kr 1,58	kr 1,49	-9,5%	-11,7%
Q2-2014	1,87	0,00492	0,12822	kr 1,75	kr 1,68	-1,4%	-2,8%
Q1-2014	1,90	8,65E-05	0,130527	kr 1,77	kr 1,73	9,2%	0,4%
Q4-2013	1,74	0,000351	0,118285	kr 1,62	kr 1,73	-2,2%	11,1%
Q3-2013	1,79	0,000155	0,124279	kr 1,66	kr 1,55	-14,5%	-15,1%
Q2-2013	2,08	0,005347	0,138319	kr 1,94	kr 1,83	2,4%	-3,8%
Q1-2013	2,03	4,4E-06	0,13547	kr 1,90	kr 1,90	-4,5%	-5,1%
Q4-2012	2,13	2,01E-05	0,142044	kr 1,99	kr 2,00	9,3%	1,6%
Q3-2012	1,95	0,000157	0,128509	kr 1,82	kr 1,97	9,7%	16,0%
Q2-2012	1,77	2,37E-05	0,117162	kr 1,66	kr 1,70	6,4%	4,1%
Q1-2012	1,67	0,00011	0,110046	kr 1,56	kr 1,63	-0,1%	8,8%
Q4-2011	1,67	1,21E-05	0,108065	kr 1,56	kr 1,50	3,0%	-6,0%
Q3-2011	1,62	0,000449	0,110258	kr 1,51	kr 1,60	-23,5%	-17,6%
Q2-2011	2,12	0,005773	0,145055	kr 1,98	kr 1,94	-1,0%	-5,0%
Q1-2011	2,14	0,004839	0,144876	kr 2,00	kr 2,04	18,0%	9,4%
Q4-2010	1,85	0,004075	0,159314	kr 1,69	kr 1,87	32,1%	11,4%
Q3-2010	1,33	0,037088	0,088053	kr 1,28	kr 1,68	23,8%	53,9%
Q2-2010	1,11	0,001122	0,073127	kr 1,04	kr 1,09	-6,3%	5,4%
Q1-2010	1,18	0,000113	0,078097	kr 1,11	kr 1,03	2,9%	-5,6%
Q4-2009	1,15	1,57E-08	0,076949	kr 1,07	kr 1,09	-16,4%	-6,4%
Q3-2009	1,37	0,008483	0,090196	kr 1,28	kr 1,17	0,4%	-11,3%
Q2-2009	1,37	0,000779	0,087889	kr 1,28	kr 1,32	-5,5%	-0,5%
Q1-2009	1,44	0,002628	0,090783	kr 1,35	kr 1,33	-3,4%	2,6%
Q4-2008	1,48	0,002338	0,08575	kr 1,40	kr 1,29	-15,0%	-16,6%
Q3-2008	1,76	0,002536	0,117848	kr 1,65	kr 1,55	-21,7%	-11,3%
Q2-2008	2,22	0,026718	0,136941	kr 2,11	kr 1,75	-2,0%	-20,6%
Q1-2008	2,28	0,006432	0,13726	kr 2,15	kr 2,20	6,5%	10,6%

KG import	NOK w/o hedge	NOK w/hedge	Difference	50/50	Difference
21 139 049	74 741 639	76 263 408	**-NOK 1 521 769**	75 502 523	**-NOK 760 885**
21 139 049	86 035 931	75 858 617	**NOK 10 177 313**	80 947 274	**NOK 5 088 657**
21 139 049	67 803 501	60 006 873	**NOK 7 796 628**	63 905 187	**NOK 3 898 314**
22 554 750	65 489 328	61 585 053	**NOK 3 904 274**	63 537 191	**NOK 1 952 137**
22 554 750	55 224 438	47 766 929	**NOK 7 457 509**	51 495 683	**NOK 3 728 755**
22 554 750	51 980 024	49 872 317	**NOK 2 107 707**	50 926 170	**NOK 1 053 854**
22 554 750	54 287 548	52 361 921	**NOK 1 925 627**	53 324 735	**NOK 962 814**
26 804 690	61 877 595	59 275 746	**NOK 2 601 849**	60 576 671	**NOK 1 300 925**
26 804 690	54 124 854	53 100 645	**NOK 1 024 209**	53 612 750	**NOK 512 105**
26 804 690	59 341 459	60 794 516	**-NOK 1 453 056**	60 067 988	**-NOK 726 528**
26 804 690	55 217 661	51 767 683	**NOK 3 449 978**	53 492 672	**NOK 1 724 989**
31 828 105	59 812 353	56 373 608	**NOK 3 438 745**	58 092 981	**NOK 1 719 373**
31 828 105	54 499 508	55 099 634	**-NOK 600 125**	54 799 571	**-NOK 300 063**
31 828 105	59 175 791	60 846 621	**-NOK 1 670 830**	60 011 206	**-NOK 835 415**
31 828 105	63 362 411	67 202 467	**-NOK 3 840 056**	65 282 439	**-NOK 1 920 028**
54 169 478	108 338 956	106 785 593	**NOK 1 553 362**	107 562 274	**NOK 776 681**
54 169 478	107 505 579	98 654 711	**NOK 8 850 868**	103 080 145	**NOK 4 425 434**
54 169 478	91 629 755	91 065 887	**NOK 563 868**	91 347 821	**NOK 281 934**
54 169 478	87 337 866	87 271 476	**NOK 66 390**	87 304 671	**NOK 33 195**
26 247 857	41 673 521	41 253 034	**NOK 420 487**	41 463 277	**NOK 210 244**
26 247 857	41 552 377	45 177 066	**-NOK 3 624 689**	43 364 721	**-NOK 1 812 345**
26 247 857	42 763 816	40 974 177	**NOK 1 789 639**	41 868 997	**NOK 894 820**
26 247 857	42 380 194	43 075 402	**-NOK 695 208**	42 727 798	**-NOK 347 604**
34 416 353	53 504 192	50 970 827	**NOK 2 533 365**	52 237 510	**NOK 1 266 683**
34 416 353	53 099 516	50 629 247	**NOK 2 470 270**	51 864 382	**NOK 1 235 135**
34 416 353	51 306 840	50 617 806	**NOK 689 035**	50 962 323	**NOK 344 517**
34 416 353	52 233 435	56 542 264	**-NOK 4 308 830**	54 387 849	**-NOK 2 154 415**
28 572 380	47 100 469	47 131 901	**-NOK 31 432**	47 116 185	**-NOK 15 716**
28 572 380	46 463 086	51 023 914	**-NOK 4 560 828**	48 743 500	**-NOK 2 280 414**
28 572 380	44 836 658	48 321 717	**-NOK 3 485 059**	46 579 187	**-NOK 1 742 530**
28 572 380	48 748 876	52 874 630	**-NOK 4 125 754**	50 811 753	**-NOK 2 062 877**
38 741 979	62 046 769	54 186 339	**NOK 7 860 430**	58 116 554	**NOK 3 930 215**
38 741 979	57 636 144	61 307 029	**-NOK 3 670 885**	59 471 586	**-NOK 1 835 443**
38 741 979	65 265 333	67 736 703	**-NOK 2 471 369**	66 501 018	**-NOK 1 235 685**
38 741 979	67 113 028	68 710 314	**-NOK 1 597 286**	67 911 671	**-NOK 798 643**
40 551 334	69 966 648	65 883 347	**NOK 4 083 301**	67 924 997	**NOK 2 041 651**
40 551 334	62 948 148	67 377 156	**-NOK 4 429 008**	65 162 652	**-NOK 2 214 504**
40 551 334	74 146 555	78 795 910	**-NOK 4 649 356**	76 471 232	**-NOK 2 324 678**
40 551 334	77 109 921	76 949 988	**NOK 159 934**	77 029 954	**NOK 79 967**
44 761 210	89 694 579	88 978 516	**NOK 716 063**	89 336 547	**NOK 358 032**
44 761 210	88 317 311	81 405 092	**NOK 6 912 219**	84 861 202	**NOK 3 456 109**
44 761 210	76 162 921	74 203 160	**NOK 1 959 761**	75 183 040	**NOK 979 881**
44 761 210	73 167 363	69 710 590	**NOK 3 456 773**	71 438 976	**NOK 1 728 387**
33 136 584	49 806 834	51 668 935	**-NOK 1 862 101**	50 737 885	**-NOK 931 050**
33 136 584	52 994 865	50 184 925	**NOK 2 809 940**	51 589 895	**NOK 1 404 970**
33 136 584	64 310 462	65 604 913	**-NOK 1 294 451**	64 957 688	**-NOK 647 225**
33 136 584	67 709 086	66 292 808	**NOK 1 416 278**	67 000 947	**NOK 708 139**
33 136 584	61 870 736	56 164 963	**NOK 5 705 772**	59 017 850	**NOK 2 852 886**
33 136 584	55 516 523	42 510 762	**NOK 13 005 760**	49 013 643	**NOK 6 502 880**
33 136 584	36 067 897	34 328 131	**NOK 1 739 766**	35 198 014	**NOK 869 883**
33 136 584	34 207 150	36 625 162	**-NOK 2 418 011**	35 416 156	**-NOK 1 209 006**
33 136 584	36 246 325	35 590 093	**NOK 656 232**	35 918 209	**NOK 328 116**
33 136 584	38 744 313	42 561 183	**-NOK 3 816 870**	40 652 748	**-NOK 1 908 435**
33 136 584	43 689 311	42 382 345	**NOK 1 306 966**	43 035 828	**NOK 653 483**
33 136 584	43 918 718	44 842 867	**-NOK 924 149**	44 380 793	**-NOK 462 074**
33 136 584	42 797 173	46 425 832	**-NOK 3 628 659**	44 611 502	**-NOK 1 814 330**
33 136 584	51 336 215	54 636 403	**-NOK 3 300 187**	52 986 309	**-NOK 1 650 094**
33 136 584	57 887 063	69 775 872	**-NOK 11 888 809**	63 831 467	**-NOK 5 944 404**
33 136 584	72 925 974	71 231 797	**NOK 1 694 177**	72 078 886	**NOK 847 088**