B.Sc. Thesis

Economics

The Market for Forward Contracts on Oil in Iceland

An assessment of market activity

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Faculty of Economics

June 2014

HÁSKÓLI ÍSLANDS

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Sigurður Ágúst Jakobsson

A thesis towards a B.Sc. degree in Economics

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Foreword

This essay is a 12 ECTS credit thesis towards a B.Sc. degree from the Faculty of Economics at the University of Iceland. I would like to thank my advisor Hersir Sigurgeirsson for the invaluable guidance and feedback provided during the writing process. I would also like to thank my parents, Fjóla and Jakob, for their support, encouragement and assistance. Their support has meant a lot to me and has pushed me to reach the goals I have set myself. Last but not least I would like to express my gratitude to the individuals that I have corresponded and conversed with about the subject of this thesis. This project would not have been possible without their kindness and the knowledge they provided.

Abstract

The aim of this thesis is to make an assessment of the Icelandic market for forward oil contracts and answer a few questions about its state as of the year 2014. The market is compared to the spot market, important participants are examined, other oil price risk management tools and techniques in use are named, and factors determining market size are explored.

Important findings include the fact that forward contracts with oil products underlying are used by Icelandic parties, including airline and oil distribution companies. Due to a lack of information available about the volume of forward contracts in use it is not possible to estimate the size of the market, yet evidence suggests that spot market transactions are the dominant method in use for physical transactions with oil products. Other risk management tools, such as swaps, options and surcharges, are also in use by Icelandic parties, and they offer important alternatives to the use of forward contracts.

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1 Introduction

Forward contracts are important financial derivatives on a global scale and serve important functions in risk management and investment fields. This thesis examines the use of forward contracts with oil products underlying by Icelandic parties.

To lead off this discussion a theoretical background about forward contracts will be given. A brief history of their applications and use will be covered outlining that the concept is quite an old one. Pricing theories for forward contracts such as the theory of storage and spot price forecasting with a premium are covered along with the no arbitrage condition theory. The use of forwards for the purpose of hedging and investment is explained along with a brief review of other derivatives that can be used for a similar purpose.

A basic understanding of certain concepts relating to the global market for oil products is important to be able to analyze the Icelandic one. Pricing practices have gone through a number of changes since the 1950s and the predominant method in the modern market is called formula pricing. There are distinct differences between the forward pricing curves of different commodities depending on the extent of their financial traits and convenience yields. Hedging for exposure to oil price risk is theorized to have different implications between different industries.

Forward contracts, along with other methods of fuel price risk management, were found to be used by Icelandic parties. The spot market is the dominant method used for physical transactions but examples exist of forward physical transactions as well. However, forward transactions with delivery are thought to be a very insignificant portion of total physical transactions.

The factors influencing the size of the Icelandic forward market were found to be impossible to determine empirically with the limited information available about the actual market size. Factors such as the capital controls in place after 2008 along with other macroeconomic factors may play a part in determining its size. The size of certain industries which use forward contracts and their business models most likely also affects their overall use. Different approaches to risk management were found between different industries.

2 A theoretical Introduction to forward commodity contracts

2.1 Forward Contracts

As far as derivatives are concerned, forward contracts are relatively simple yet useful instruments available for various purposes. At their most basic level they are binding agreements between two parties to exchange goods, one side often paying money, at some predetermined future date. One can juxtapose this type of business with spot contracts where goods are exchanged essentially instantaneously, and the time element makes it so that it can serve purposes for risk management and speculation which will be covered later in this thesis.

When studying forward contracts it is a good starting point to contrast them with futures contracts, and briefly cover the history of both types of these similar derivatives. Some of the main differences between forwards and futures are where they are traded, the characteristics of the terms associated with their dealings, risks associated with them, and also their role throughout history.

A forward contract is an arrangement made between parties in the over the counter market, meaning that it is not made at an exchange, called OTC hereafter. These contracts can be highly diverse in their terms and comprise a much larger portion of the market than futures contracts. Futures are standardized contracts that are traded between an independent party and a derivatives exchange which acts as a central counterparty to business between many parties. These different forms of similar contracts have different pros and cons associated with them. Futures exchanges lower counterparty risk and transaction costs while forward contracts can offer much more customization. Futures contracts are also marked-to-market daily as opposed to forwards where gains or losses are realized at the end of the contract or when it is closed out.

Weber (2008) notes that much of the literature about the history of derivatives only deals with recent accounts from around 1970 onwards. Around this time derivatives exchanges started to grow in a significant way and one can speculate that this fact made information significantly easier to gather about these dealings and has therefore shifted attention to this relatively small sector of the whole market.

"The history of derivatives has remained unexplored because there are few historical records of derivative dealings. Derivatives left no paper trail because they are private agreements that have been traded in over-the-counter markets for most of their history. Even today, the international commodity and financial markets, which have always been a primary focus of derivative dealings, remain beyond the reach of national statistical offices." (Weber, 2008, p. 1)

Weber actually traces examples of business with forward contracts back as far as 1800 BC in what is now the middle-east. This is not so hard to imagine since an over the counter forward contract can be a relatively simple arrangement. He also explains that in the 1500's AD traders started realizing they did not have to settle contracts by delivering the goods and could instead pay the difference between the spot and future price agreed on.

"Contracts for differences were precursors of modern futures contracts. Like contracts for differences, futures contracts are usually settled by paying the difference between the delivery price and the spot price of the underlying asset, instead of delivering the asset itself. But futures have some safeguards that contracts for differences did not possess. Both parties in a futures contract must maintain a margin account into which some money must be paid up front." (Weber, 2008, p. 12)

In the 1970s, after academic breakthroughs in options valuation, there was an increase in the number of large exchanges trading derivative products in the United States according to Deutsche Börse Group (2008). In the 1980s and 90s there was similar growth in this sector in Europe. These exchanges trade futures contracts which

are standardized versions of OTC products that have shown enough popularity to warrant trading in large volume. The standardization and exchange trading of futures contracts lowers counterparty risk since the individual client only deals with exchanges that are usually financially strong and have risk mitigating measures in place such as margin requirements for traders. Legal risk is also lowered by trading on exchanges since the standardization of the contracts and local nature means that there is little doubt of how the legal system will rule if disputes arise. Yet another benefit of trading futures on exchanges is that transaction costs are relatively low compared to the OTC market. It is not costly or time consuming to find a trading partner and the standardization of contracts can save time and costs associated with negotiating customized terms. One of the downsides of exchange traded futures is of course the fact that they are not customizable and not all market participants will be able to find products that suit them in this sector. The OTC forward contract market also has its own measures to lower the types of risk mentioned above.

It is at this point, after taking a very brief look at the history and some of the differences of futures and forwards, that it is ideal to look at their role in the modern marketplace. OTC derivatives are used in much greater volume than exchange traded derivatives. In the accompanying figures one can see the market share of OTC contracts as opposed to exchange traded contracts as a share of the total derivatives market and how the market has been growing in the last years.

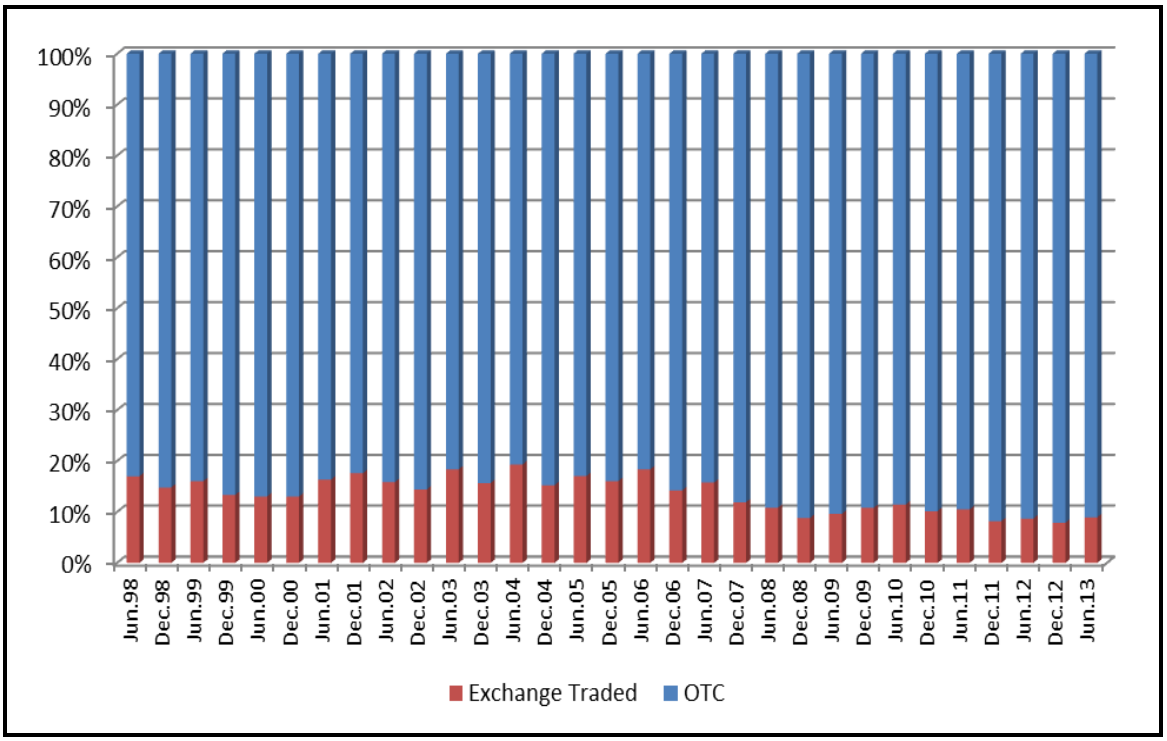

Figure I – Share of total outstanding derivatives contracts worldwide in notional amounts. Source: Bank for International Settlements (2013).

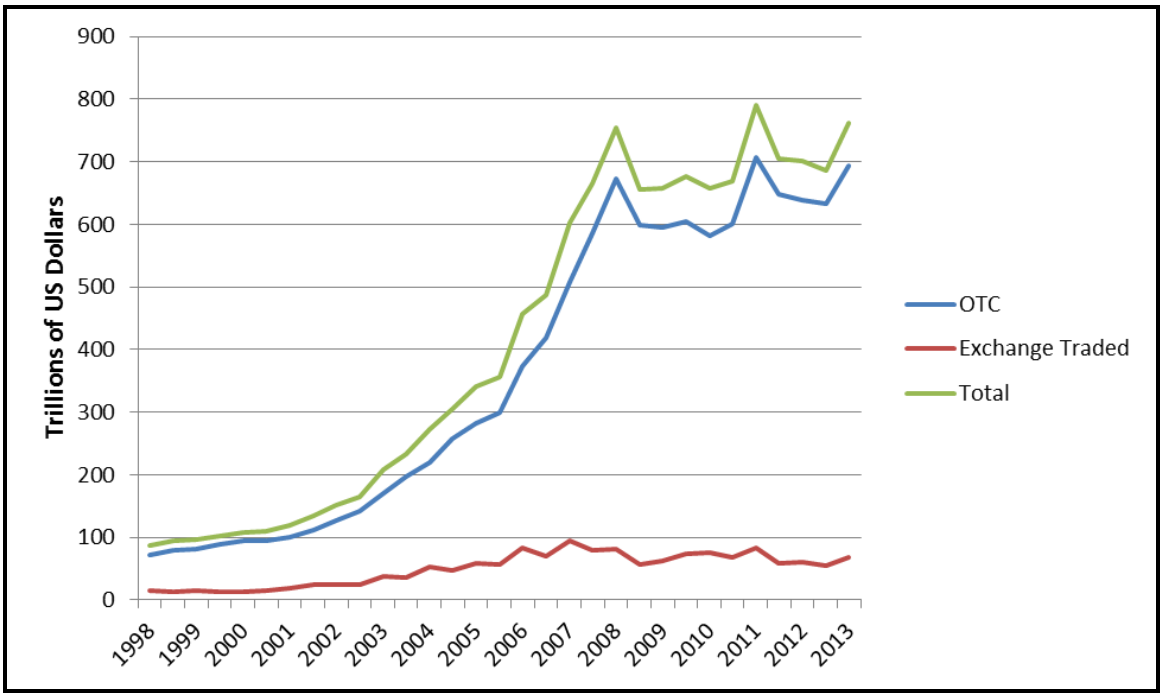

Figure II – Notional amounts of derivatives contracts outstanding worldwide. Source: Bank for International Settlements (2013).

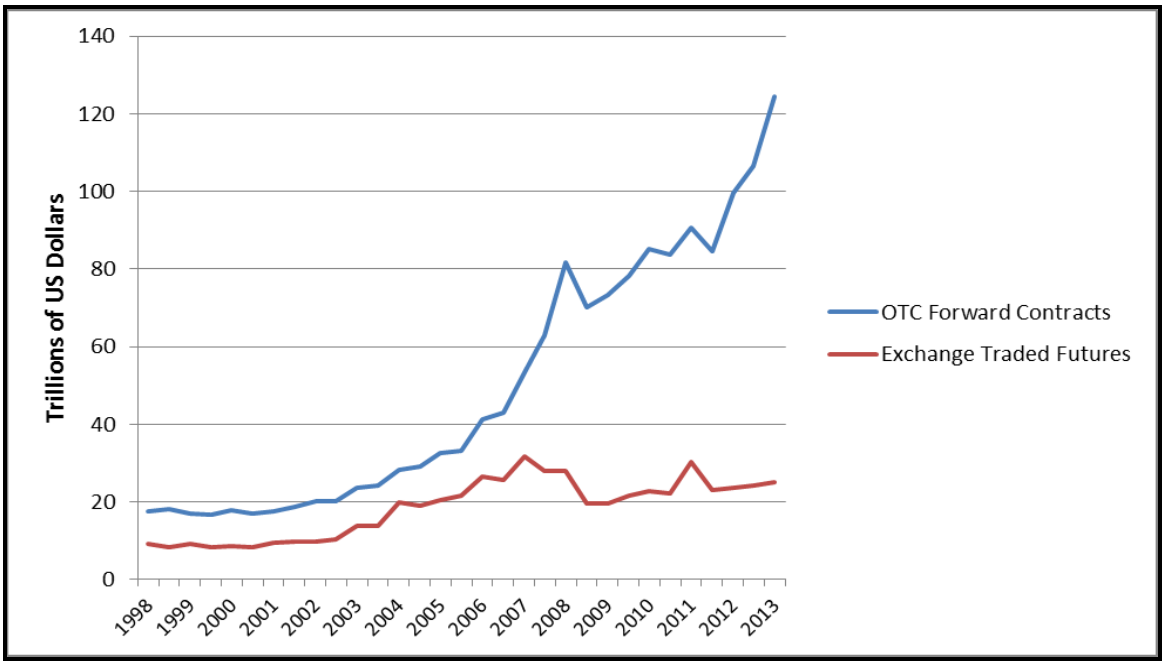

Figure III – Notional amounts of Forwards/Futures outstanding worldwide. Source: Bank for International Settlements (2013).

As can be seen in Figures I - III the OTC sector has been growing at a higher rate than the exchange traded one and therefore its market share is growing compared to it. The difference in utilization of forwards and futures is not as large as the difference between the OTC and exchange traded sectors for all derivatives, but there is still a clear difference and the volume of outstanding OTC forwards is much larger. This thesis does not go into the reasons for this difference in utilization. The growth in the last 15 years of derivatives markets is quite large compared to other financial sectors according to Deutsche Börse Group (2008). According to them some of the reasons for this growth are technological innovation and product innovation along with an increase in market efficiency.

2.2 The pricing of Commodity Forwards

The pricing of forward contracts for consumption assets is based on a number of variables including the spot price, interest rates, storage costs, and convenience yields. When looking at the basics of this sort of pricing one can look at the pricing of

investment assets to get an intuitive understanding of how it works, yet it is very important to bear in mind that there are some clear distinctions between the methods and the same arguments do not hold for both.

The pricing of forward contracts for investment assets relies on a no arbitrage argument which states that if the forward price does not conform to certain conditions there will be arbitrage opportunities in the market which will be exploited by its participants and will drive the price to a level which does conform with them (Hull, 2008). The forward price derived by this method is $F_0 = S_0e^{rT}$ where F_0 is the forward price, S_0 the spot price, r the continuously compounded risk free rate and T the time to maturity of the contract.

To see how the argument works one can assume that the conditions break and see how arbitrage opportunities arise. If $F_0 > S_0e^{rT}$ an investor can take a short forward position, take a loan for S_0 to buy the underlying asset, repay the loan S_0e^{rT} at T and sell the asset at F_0, locking in a profit of $F_0 - S_0e^{rT}$. If $F_0 < S_0e^{rT}$ an investor can take a long forward position, short sell the asset for S_0, invest the proceeds and realize S_0e^{rT} at T, buy the asset for F_0 and return the short sold asset, locking in a profit of $S_0e^{rT} - F_0$. Short selling the asset does not have to be possible as long as enough people hold it as an investment good, as they can exploit arbitrage opportunities if they arise and pressure the price to reach the equilibrium again; this is one of the main differences between financial asset and consumption asset pricing.

Hull (2008) also shows that this method can be amended to take consideration of known income from the underlying asset during period T and known yield but that it is actually not suitable for pricing contracts with underlying consumption goods (such as oil) because the arbitrage arguments do not hold. When $F_0 > S_0e^{rT}$ arbitrage opportunities still arise because the same methods as described above are still possible with consumption goods, but when $F_0 < S_0e^{rT}$ arbitrage opportunities do not arise because owners of consumption goods generally prefer to consume or otherwise use them over period T rather than sell them and purchase them back via long forward

positions. This means that the pricing of forwards with underlying consumptions goods only conforms to the condition $F_0 \leq S_0 e^{rT}$.

The fact that no-arbitrage arguments don't hold for commodities forwards leads to the fact that slightly different approaches are needed to yield accurate and valid price estimates. Two popular theories are the theory of storage, and the theory that the prices are composed of a forecast of spot prices and a risk premium which have been explored and summarized by Fama & French (1987).

2.2.1 Theory of Storage

The theory of storage can be put forward in the form of the equation:

$$F_0 - S_0 = S_0 R_0 + W_0 - C_0$$

Where F_0 is the price of a forward contract with delivery at time T, S_0 is the spot price, R_0 is the interest rate over the period of the contract, $S_0 R_0$ is interest forgone by holding the commodity, W_0 the marginal storage cost, and C_0 the marginal convenience yield. $F_0 - S_0$ is called the basis and is the difference between the forward and spot prices. (Fama & French, 1987)

The intuition for this method is that if an investor were to purchase a commodity and enter into a short forward position [$F_0 - S_0$] with delivery at time T they would incur the costs on the right side of the equation [$S_0 R_0 + W_0 - C_0$] so the basis must equal these costs for the investor to be indifferent between executing this strategy or not.

The economic cost of the interest forgone should be a relatively self-explanatory reason for the investor to demand compensation and when handling commodities storage costs should be as well. Commodities, whether for consumption, such as corn, or not, such as gold, need to be stored and this cannot be done without incurring some cost. The value of perishable goods can also decrease over time if stored too long and this depreciation also factors into the storage cost. Convenience yields are the benefits which a holder of an asset gains by holding it in inventory. Keeping an asset in inventory

can allow the holder to benefit from its usage value and profit from temporary shortages of the asset (Hull, 2008). There are also examples of owners of precious metals leasing them out and earning profits in that way.

This theory predicts that there is a negative correlation between existing inventories of a commodity and its convenience yield since it is harder to profit from shortages when inventories are high and for many assets these factors, and therefore the basis, will vary seasonally as inventories and demand change. Regression analysis also suggests that interest rates have varying effects on forward prices for different assets depending on their type. This theory of storage is generally not very controversial (Fama & French, 1987).

Hull (2008) puts this theory forward in a slightly different and more explicit manner, and refers to it as the cost of carry. He gives an equation $F_0 = S_0 e^{(r+u-q-y)T}$ for the forward price where r is the risk free interest rate, u storage cost, q income rate (if applicable), and y convenience yield, all expressed as a percentage of the spot price with continuous compounding.

2.2.2 Theory of Spot Price Forecasts and Risk Premium

Fama & French (1987) explore the theory of spot price forecasts and risk premium and say that historically it is more controversial and disputed than the theory of storage. Their regression analysis suggests that it is valid for some types of commodities, but they conclude that their evidence is not strong enough to give definitive answers or confirm whether this method gives significant results. The premise behind it is explained in a slightly different but more intuitive way by Hull (2008) and his approach will be detailed hereafter.

In the Capital Asset Pricing Model investors will require a premium in addition to the risk free interest rate to take positions bearing positive systematic risk. The intuition

behind this theory is that an investor can enter a long forward position at present value $-F_0e^{rT}$ and sell the asset immediately at the end of the contract for S_T which is worth $E(S_T)e^{-kT}$ at present value, where k is the required return the investor expects for an investment with systematic risk. The pricing of forwards leads to the net value of the transaction being 0 and it can be represented mathematically as $-F_0e^{rT} + E(S_T)e^{-kT} = 0$, which can be rearranged into $F_0 = E(S_T)e^{(r-k)T}$ to give the forward price. If there is no systematic risk then $r=k$ and the equation becomes $F_0 = E(S_T)$; the forward price is then only dictated by the expected spot price.

2.3 Reasons for using forward contracts

The use of forward contracts and derivatives in general can benefit investors and companies in various situations but in general they are used in two ways.

"Derivatives make future risks tradable, which gives rise to two main uses for them. The first is to eliminate uncertainty by exchanging market risks, commonly known as hedging. [...] The second use of derivatives is as an investment. Derivatives are an alternative to investing directly in assets without buying and holding the asset itself." (Deutsche Börse Group, 2008, p. 6)

2.3.1 Hedging

Forward contracts are a very useful tool for market participants to hedge risk. If perfect hedges are available, participants can lock in either parts of their future expenses or revenues and lower the risk associated with certain parts of their operations by using such contracts. If the assets that participants want to hedge for are not available to trade they can still partially hedge their risk away by trading assets that have correlation to each other called cross hedging, and in this case one must explore concepts such as hedge ratios. Timing of contracts can also complicate matters and in general these barriers to perfect hedges are called basis risk (Hull, 2008).

When looking for examples where forwards can be useful hedging tools in commodities markets one could for instance put forward a simplified scenario of an airline which sells tickets for a flight one year in advance and prefers to take no chances with fuel prices. It expects the plane to be full and therefore can forecast its revenues, but if it were to buy the fuel in the spot market at the time of the flight there would be risk involved generated by the fact that prices could rise which the pricing of tickets wouldn't reflect, potentially leaving the flight to operate at a loss. Instead of taking this risk the airline could enter a long hedging position by purchasing oil in the forward market with delivery in a year. In this way the airline could remove variability from this part of its expenses for the flight lowering the risk of running it at a loss. It is also very important to note though, that the airline would forgo the additional profits it would receive if the price of oil had gone down during the period. To explore how a short hedging position would work with oil, one could envision a scenario of an oil producer contemplating if he should invest in the building of a new well but is unsure if oil prices will stay high enough to make it worth his while. To make sure that he generates the required returns on investment he could sell the oil he hopes to obtain from the well in the forward market and take a short hedging position. This would guarantee him a fixed return on his investment which he could also not exceed if oil prices were to rise.[1]

These scenarios assume that the hedgers can enter into contracts with their specified assets and maturity matching their needs, so they are perfect hedges. This possibility does not always exist in the real world where assets that hedgers want to hedge are not always available, or the delivery time does not match the time they will want to obtain or sell the assets. One example is of exchange traded futures where there is a limited selection of products that are traded with delivery dates that are non-negotiable. This leads to basis risk where basis is defined as $b_0 = F_0 - S_0$ as explained in the pricing section. Since the forward price converges with the spot price as time approaches the delivery date, the basis should be zero at time T if the hedger can enter into a contract for the

[1] This is similar to an example given by Campbell, Orskaug, & Williams (2006)

asset he is hedging for and with the delivery date the same as the date on which he wants to deliver or accept the asset. If he cannot enter into a contract for the asset he is hedging his risk for, he may decide to cross hedge with a different asset whose price is correlated. Then the F_1 and S_1 will most likely not converge completely at time T and the basis will not equal 0 at the time the contract will be closed out. If the delivery date of the contract is not the same as the time the hedger is hedging his exposure for, F_1 and S_1 will not have converged when the contract is closed out leaving a non-zero basis. The basis being non-zero at the time the contract is closed out is important because the effective price that is received on a short hedge is $F_0-F_1+S_1 = F_0-b_1$ and the price paid on long hedge is also $F_0-F_1+S_1 = F_0-b_1$ where time 0 is the time the contract is entered into and time 1 is the time it is closed out. If there was no basis risk the price paid or received would simply be F_0 and the futures contract would be more effective at reducing risk (Hull, 2008).

When cross hedging is used, it is not always optimal to hedge for the whole position and there is a ratio of the cross hedging asset, compared to the one whose price is being hedged, that will minimize the variance of the value of the hedged position. This ratio is called the minimum variance hedge ratio. The minimum variance hedge ratio is defined as $h^* = \rho\, \sigma_S/\sigma_F$ where ρ is the coefficient of correlation between the change of spot and futures prices over the time equal to the length of the hedge and σ_S/σ_F are the standard deviations of spot or futures prices over the time equal to the length of the hedge. When there is a perfect hedge available this ratio is equal to 1. (Hull, 2008)

As explained earlier, hedging can lead to worse results than if commodity prices had not been hedged. In industries where prices follow the change in costs of commodities used as inputs to production, hedging can lead to a competitive disadvantage if firms in the industry generally do not practice it. Some of the benefits of hedging have now been explained, mainly in the fact that it reduces the variance of firms' profits, decreasing the likelihood of lower end performance. Some of the technical aspects of hedging have also been explained. Whether reducing variance actually benefits firms has not been explored however. Smith & Stulz (1985), Campello, Lin, Ma, & Zou (2011),

Jin & Jorion (2006), and Carter, Rogers, & Simkins (2006) have all contributed to the literature exploring the topic of firm valuation and hedging in different ways. Jin & Jorion (2006), and Carter, Rogers, & Simkins (2006) explore this connection in the U.S. Oil & Gas production industries, and U.S. airline industries respectively and report different findings which will be revisited later. Smith & Stulz (1985) put forward a few theories for how hedging can increase firm value while Campello, Lin, Ma, & Zou (2011) take a look at similar factors with the help of empirical evidence.

The literature about this topic generally focuses on the fact that, according to Modigliani-Miller propositions in perfect capital markets, corporate financing and active risk management are irrelevant to the value of large widely held firms, because investors can adjust their portfolios to change their risk exposure and expected returns themselves. Smith & Stulz (1985) use this argument to show that the increase in firm value through hedging must be derived from tax considerations, bankruptcy costs and its effect on investment decisions. When marginal tax rates on corporations are increasing and post-tax value of a firm is a concave function of its pre-tax value, hedging can reduce the variability of pre-tax values, reduce expected tax liabilities and increase the firms expected post tax value if the cost of the hedge is not too high. If hedging reduces the variability in a firm's pre-tax value it can also lower its expected bankruptcy costs if they are a decreasing function of firm value, and therefore increase its post-tax value.

Campello, Lin, Ma, & Zou (2011) find that hedging improves the terms of firms' debt financing. They find that firms in their sample that hedge for interest rate and foreign exchange risk face significantly lower loan spreads by performing regression analysis. They also find that hedging reduced incidences of restrictions in loan agreements giving firms greater flexibility to invest.

Lastly Smith & Stulz (1985) theorize that another reason why some firms might hedge could be because of personal preferences of their management and the compensation plans they face. This is not a benefit of hedging but a reason why it may

occur. Risk averse managers may find that it maximizes their personal profits to hedge risks their firm faces if their compensation plans incentivize or at least don't disincentivize this. This might be in line with what ownership of a company wishes for, but it might also be against their best interests. This shows the importance for firm owners to design the incentive packages of their management correctly with regards to value maximization.

2.3.2 Investment

Another use for forward and futures contracts is as an investment and speculation tool. Since the focus of this thesis is the Icelandic market for oil forwards this subchapter will be very brief as the assumption is made that it is used mainly for hedging purposes. The investment application of forward contracts is not applicable to this thesis and will not be covered very extensively.

The fact that these types of contracts are valued at zero when they are entered into means that investors do not need to make large investments to take positions in the underlying assets themselves, and only have to own enough cash to put into a margin account to gain exposure to their price changes. Speculation and investment with futures provide investors leverage, as much less cash is needed to realize similar returns as would be realized by holding the underlying asset (Hull, 2008).

Forward contracts and futures also allow investors to take positions against assets in a similar fashion to short selling them (Deutsche Börse Group, 2008). If an asset falls in value the owner of a short futures position profits from it, opposite of that would happen if they owned the asset. Since short selling has historically faced various restrictions and the fact that it is not practical with certain types of assets, namely commodities, futures are a good alternative to it to obtain similar results.

2.4 Other derivatives used to hedge exposure to energy commodity prices

Along with forward contracts, other types of derivatives can also be used to hedge exposure to asset prices. Options and swaps are popular instruments which can be used for this purpose and they are mostly traded in the OTC market and can be customized to meet users' needs (Campbell, Orskaug, & Williams, 2006). Swaps offer the ability for their users to pay a fixed rate for a commodity and receive a floating price or the other way around, and the net effect is that they receive or pay cash flows which are the difference between the two prices. Swaps should be designed so that the cash flows hedge the users' exposure to the underlying commodities, if their purpose is for hedging. Swaps are useful since they provide cash flows over a preset period of time at fixed intervals so there are often more of these flows than in a single forward contract. If a hedger uses swaps he does not have to take delivery terms into consideration. In general a commodity producer would want to receive a fixed price and pay the floating price while a commodity consumer would take the opposite approach.

Along with price risks, energy producers can also face volume risks as Hull (2008) points out. Prices are often not perfectly related to volume and certain types of derivatives can be used to hedge volume risk. One type of derivative he mentions is weather derivatives. An example of this could be for an electricity company to use weather derivatives if its customers generally use electricity to heat their houses during winter. A relatively warm winter could mean that less electricity is used than they would hope for and weather derivatives whose payoffs depend on temperature conditions over a certain period could be used to hedge against this volume risk. Weather derivatives often take the form of options with payment caps.

In general, derivatives can be used in very creative ways and can be designed to hedge for most kinds of risks. Energy companies and energy users often have fairly sophisticated ways of using derivatives to this end, other than simply using plain forward contracts.

3 The Global market for forward oil contracts

The global market for oil products is a very important sector of overall world energy markets and has important economic implications in both consumer and producer sectors. Figure IV shows the world's energy consumption by proportion of primary fuel type used in the year 2012 which illustrates the large role that oil products play in satisfying modern energy demands.

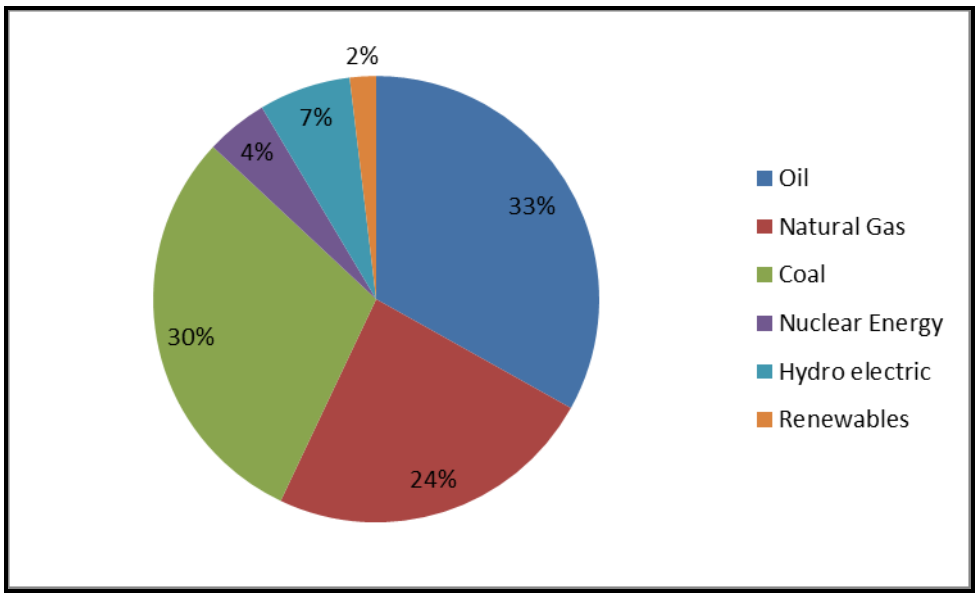

Figure IV – Primary fuel sources as percentages of world energy consumption in 2012. Source: BP p.l.c. (2013).

This chapter aims to shed light on some of the workings of the global market for oil in general as well as taking a look at global forward markets to set up the coverage of the Icelandic spot and forward markets in the next chapters.

3.1 The global market for oil and general oil consumption

In the last 25 years worldwide oil consumption has been growing somewhat with increases mainly attributable to non-OECD countries. The graph below shows oil consumption in six countries around the world at different stages of development. Consumption in Germany and the United Kingdom stayed fairly stable over the period with slight decreases after 2007, while the United States steadily increase their consumption until 2007 where there are notable decreases. The less developed

countries of China, India, and Brazil showed a steady growth in consumption over the whole period with no noticeable decrease after 2007. Even though it is not present on the Figure V due to its low consumption compared to the others, Iceland follows a similar trend as the United States, steady growth until 2007 with decreases thereafter.

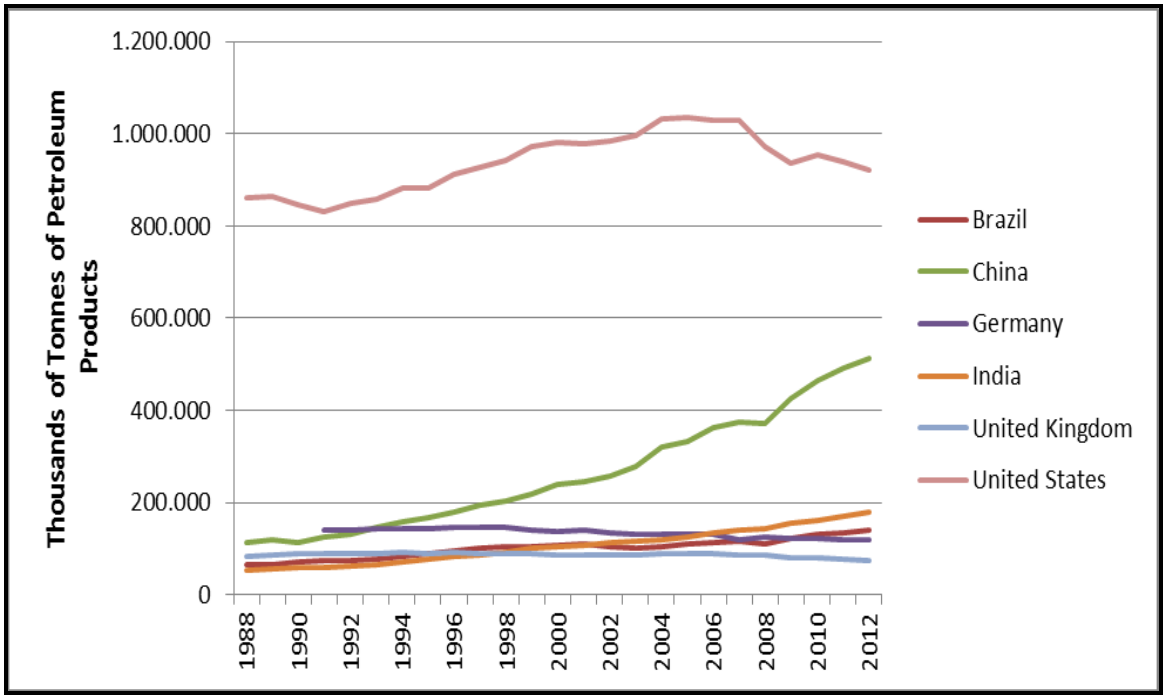

Figure V – Oil consumption by country. Source: U.S. Energy Information Administration (2014a).

It is interesting to look at how oil and energy use per capita has developed during that same time period. Oil consumption per capita has been declining in the OECD countries included in the graphs below while it increases in the non-OECD countries and stays relatively stable worldwide. Energy use in general follows similar trends. The OECD countries, excluding Iceland, have been using less and less energy per capita over the time period while the non-OECD countries are increasing their energy consumption per capita. In total, energy consumption per capita worldwide has been increasing. The fact that energy per capita rises dramatically in Iceland while oil consumption falls can be explained by large increases in geothermal and hydroelectric power production and consumption that is largely used for industrial purposes.

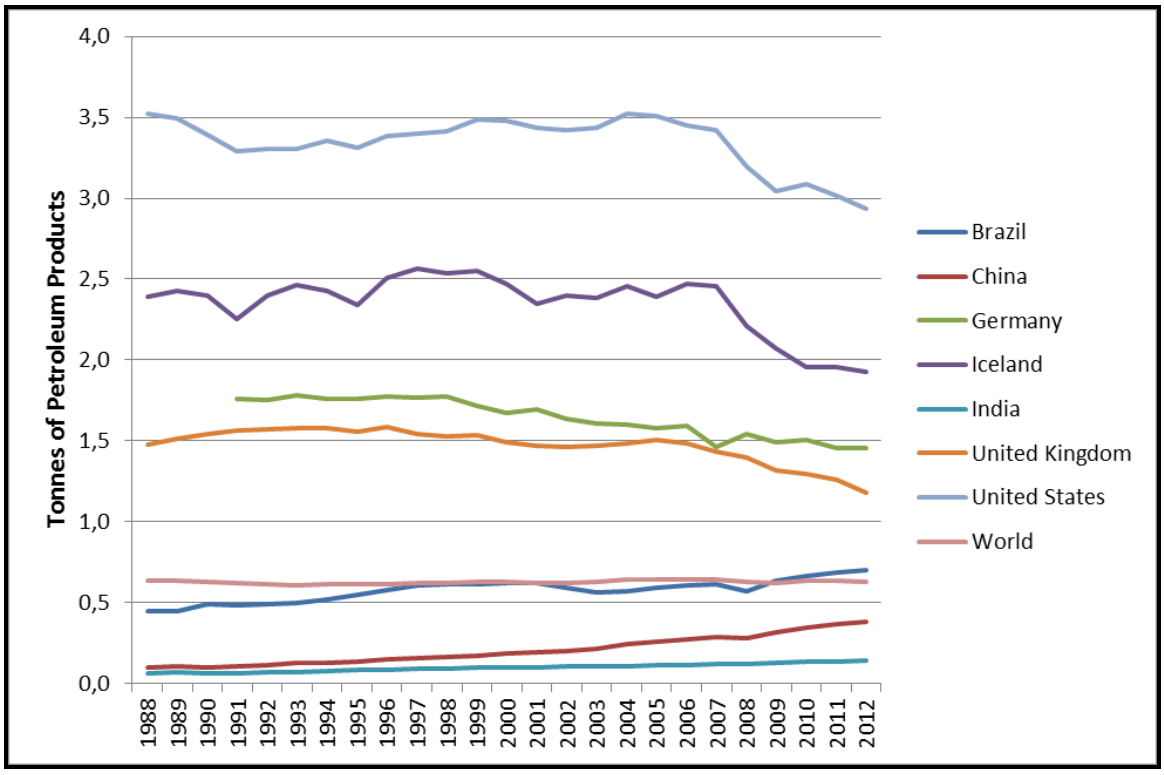

Figure VI – Tonnes of Petroleum products used per year per capita. Sources: U.S. Energy Information Administration (2014a), Statistics Iceland (2014a), The World Bank (2014c), and personal calculations.

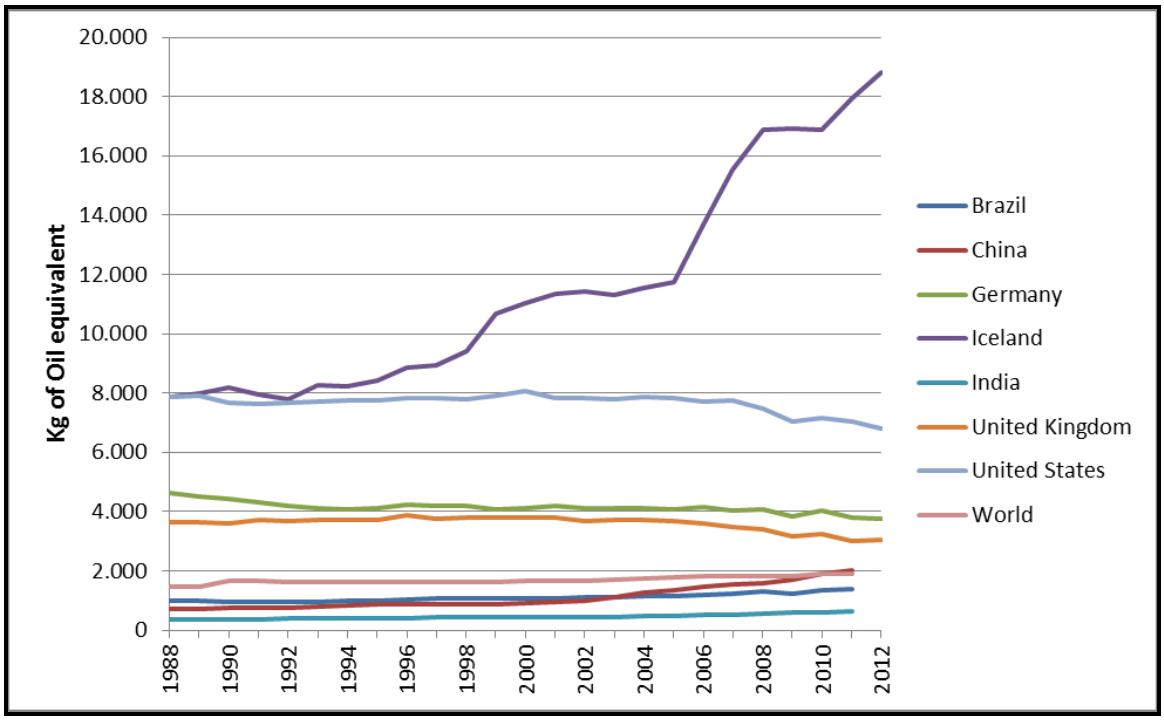

Figure VII – Energy use per year per capita. Source: The World Bank (2014a).

Another interesting trend when looking at worldwide oil consumption is its relationship with real GDP. Oil consumption per unit of real GDP has been declining worldwide. The fact that real GDP has been converted into dollars has potentially warped Figure VIII for countries whose exchange rates fluctuate significantly against the USD but the overall downward trend is still quite easy to see over time. The fact that more value is being produced in the economies in Figure VIII, using less oil likely has a number of explanations. Some reasons include machinery and production processes using oil becoming increasingly efficient and sectors of the economy, service sectors for instance that don't rely heavily on energy, growing in high income countries. Lastly some processes using oil have moved on to alternative energy sources. Reasons for increased productivity and movement to alternative energy sources include technological advancements, oil price increases, and pressure to use more environmentally friendly and sustainable processes in production and consumption.

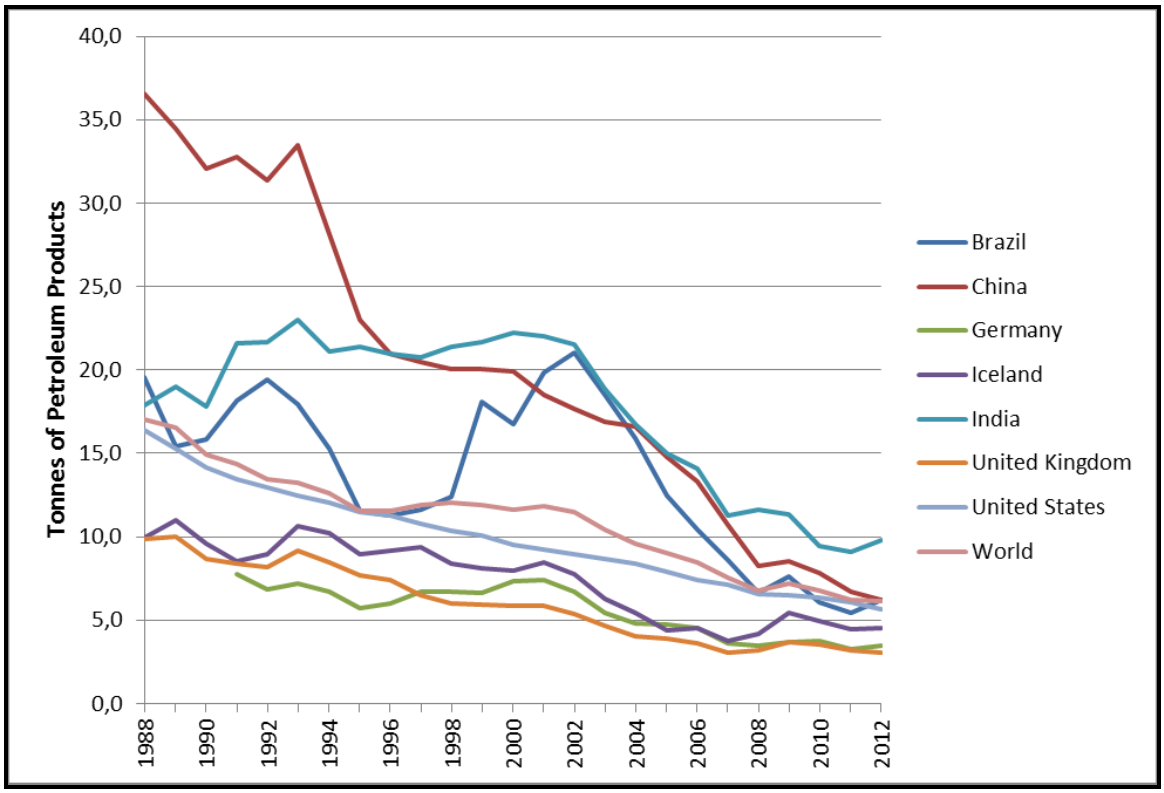

Figure VIII – Tonnes of Petroleum products used per year per 100.000 USD of real GDP. Sources: U.S. Energy Information Administration (2014a), Statistics Iceland (2014a), The World Bank (2014b), and personal calculations.

The method by which oil is priced and traded between large users and producers is important to understanding how the market works. Fattouh (2011) explains that there have been several different market structures for pricing oil since the middle of the 20th century. A few large multinational oil companies controlled the industry outside the United States, Canada, USSR and China until the late 1950s with host governments receiving royalties and income taxes from their operations. The companies were vertically integrated controlling much of the process from production of crude oil to refinement and in this oligopolistic system no free market could form outside of them. The companies posted prices that did not reflect free market conditions.

In the late 1950s smaller independent companies had received rights to produce crude oil in a number of places around the world creating a market outside the large companies introducing competition and influencing them to lower their posted prices. The formation of OPEC was a response to this added competition as its members wanted to keep their income from declining. In the late 1960s and early 1970s there were large increases in global oil demand and by 1973 OPEC countries accounted for a little over half of the world's crude oil production. OPECs influence over the multinational companies increased during this period and it eventually came to control the setting of the posted price. OPEC significantly raised the posted price and cut down production in the later part of 1973. OPEC members negotiated shares in, and in some cases the nationalization of, companies around this same time significantly changing the way the market operated. OPEC governments received shares of the oil produced by oil companies. Due to the fact that they could not integrate further into the production process the share was sold to third parties using what was called the official selling price, or back to the original production companies at buyback prices, while they still used the posted price for other transactions. This system of three types of prices was complex and inefficient, and since the market was not very transparent they did not necessarily converge. This system did not last long and by the mid-1970s a new one had evolved where OPEC members were able to set prices of their products relative to a specified marker price. (Fattouh, 2011)

Under this marker system the large multinational companies still purchased most of the oil from national producers. In the late 1970s the national producers started to sell their oil to a broader clientele and in 1979 they found it advantageous to cancel long term deals selling oil to the large companies at the marker price, enabling them to sell this oil to the highest bidders at the marker price plus an additional markup. This had the effect of making the purchasing side of the industry more competitive. Yet as new oil discoveries were made outside of the OPEC area, oil demand decreased in the mid-1980s and OPEC started to dramatically lose market share. It lost the influence needed for its administered pricing system to work. Non-OPEC producers were able to offer lower prices and the whole system eventually turned into a market based pricing system. (Fattouh, 2011)

Fattouh (2011) further explains that in the modern market a method called formula pricing is used to price oil contracts. This means that a benchmark is used as the base of the price and then a premium or discount is added depending on the quality of the crude oil being traded. Examples of important benchmarks are Brent crude oil and West Texas Intermediate (WTI) crude oil and these are actual types of crude oil that originate from sources in the North Sea and southern United States respectively. The benchmarks are calculated by oil price reporting agencies which collect market data of transactions. The data is then analyzed through their preferred methods and the benchmark found. The actual oil types used for the benchmark only comprise a very small part of the total volume of the total market but are used to calculate the transaction prices for oil of other origins. These benchmarks are generally what is being talked about when the global price of oil is referenced. Oil is not a homogenous good which is why premiums and discounts are used when determining the transaction prices of crude oil of other origins. Crude oil can have different densities and varying sulfur content and these factors determine the complexity of its refining process and its worth.

Lastly Fattouh (2011) explains how the logistics and format of oil transactions are set up between buyers and sellers using either spot deals or long term contracts. In the

case of long term contracts they often take the form of series of agreed upon shipments over the span of one or two years and the price of each shipment is determined using formula pricing at predetermined times during the contracts tying the prices to spot prices. In the case of single spot transactions the actual delivery is often made some time after the deal is made[2] due to the logistical complexities of transporting large amounts of oil. Prices can be determined at the time of the deal making the transaction similar to a forward contract[3], or they can be determined at the time that the oil is transported. Figure IX is a chart showing three benchmarks for spot prices.

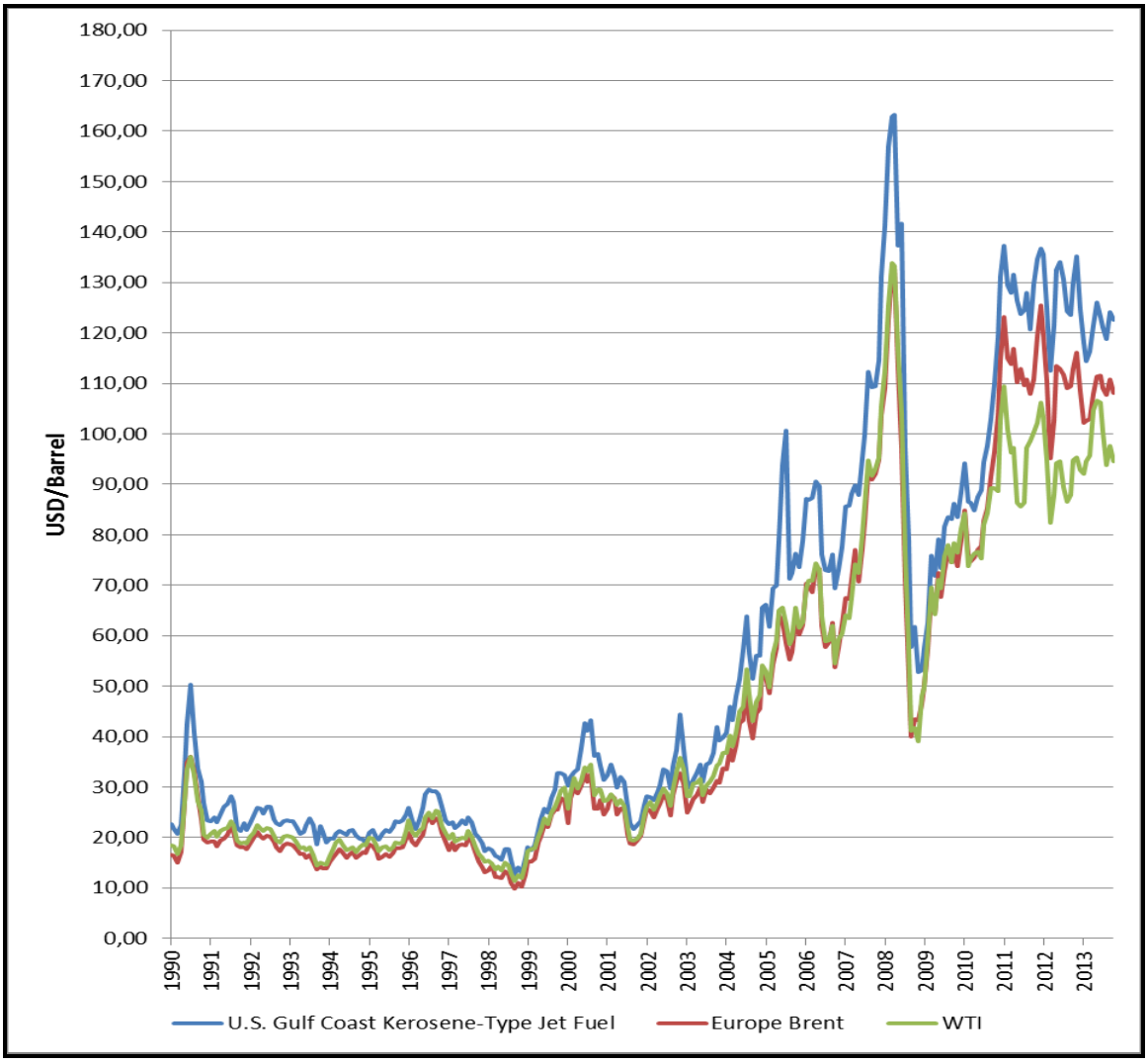

Figure IX – Spot prices of two crude oil benchmarks and Jet fuel. All prices FOB. Source: U.S. Energy Information Administration (2014b).

[2] Up to two months

[3] Whether it is actually a forward contract is often a matter of legal definitions.

3.2 Specifics to the pricing of forward oil contracts

In general the pricing of forward oil contracts follows the ideas and principles described earlier in this thesis about the pricing of commodities futures. There are some topics on forward pricing that relate specifically to oil however and others that can be explored by looking at these prices. Two important concepts to have in mind when dealing with futures or forward contracts are backwardation and contango, which are terms describing the slope of the forward pricing curve. If a forward/futures curve is in contango this means that the prices slope upwards over time and are above the spot price, while the curve is said to be backwardated if the prices slope downwards and are below the spot price. At the time this thesis is written oil futures are in a state of backwardation and Figure X shows an example of this. Figure XI is a graph of the gold futures curve to show what contango looks like. Theoretically the reason why the curves slope either upwards or downwards can partially be explained by the no arbitrage argument method of pricing and the theory of storage. Forward curves for assets with financial properties that have storage and interest costs slope upwards while the convenience yield of consumable assets can cause these curves slope downwards (Routledge, Seppi, & Spatt, June 2000). In mathematical terms it is represented by $dF_0/dT = (r+u-q-y)S_0e^{(r+u-q-y)T}$ showing that a mixture of the level of interest rates, storage costs, convenience yields and income determine the slope according to this pricing method. The fact that gold has much stronger financial qualities than crude oil can explain why the curves on Figures X and XI are shaped as they are.

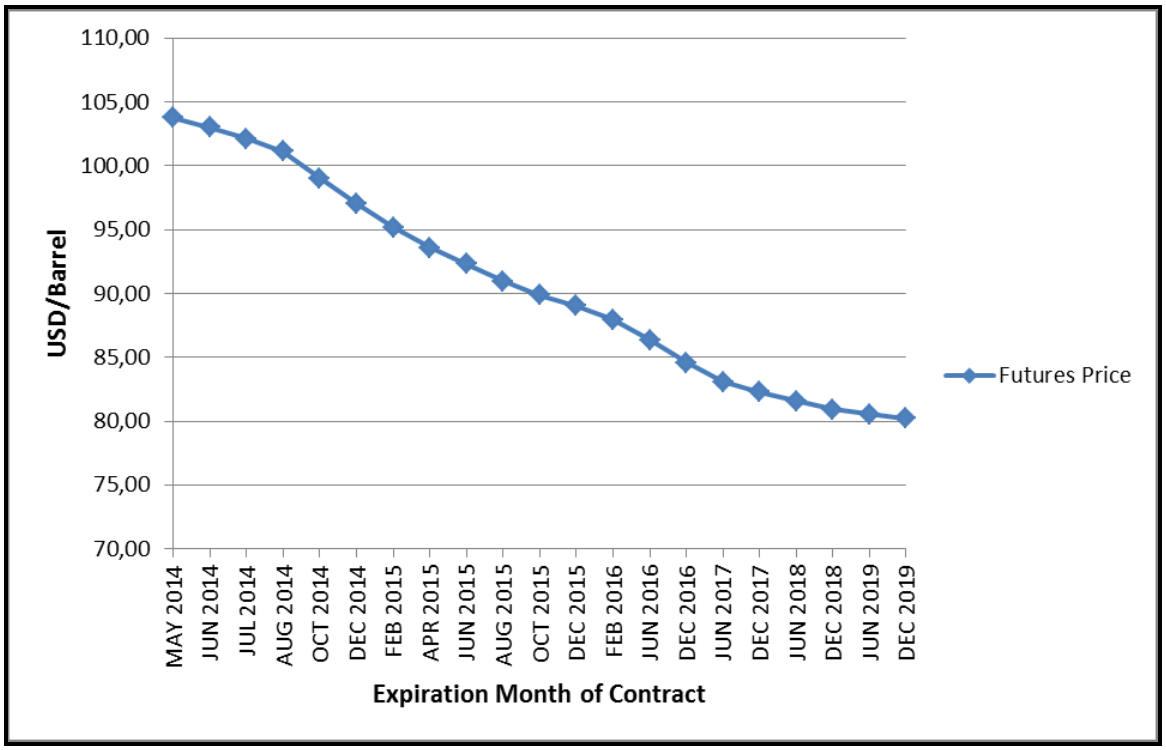

Figure X – The futures price quote of crude oil (WTI) from NYMEX as of the end of trading on 15.04.2014. Source: CME Group (2014a).

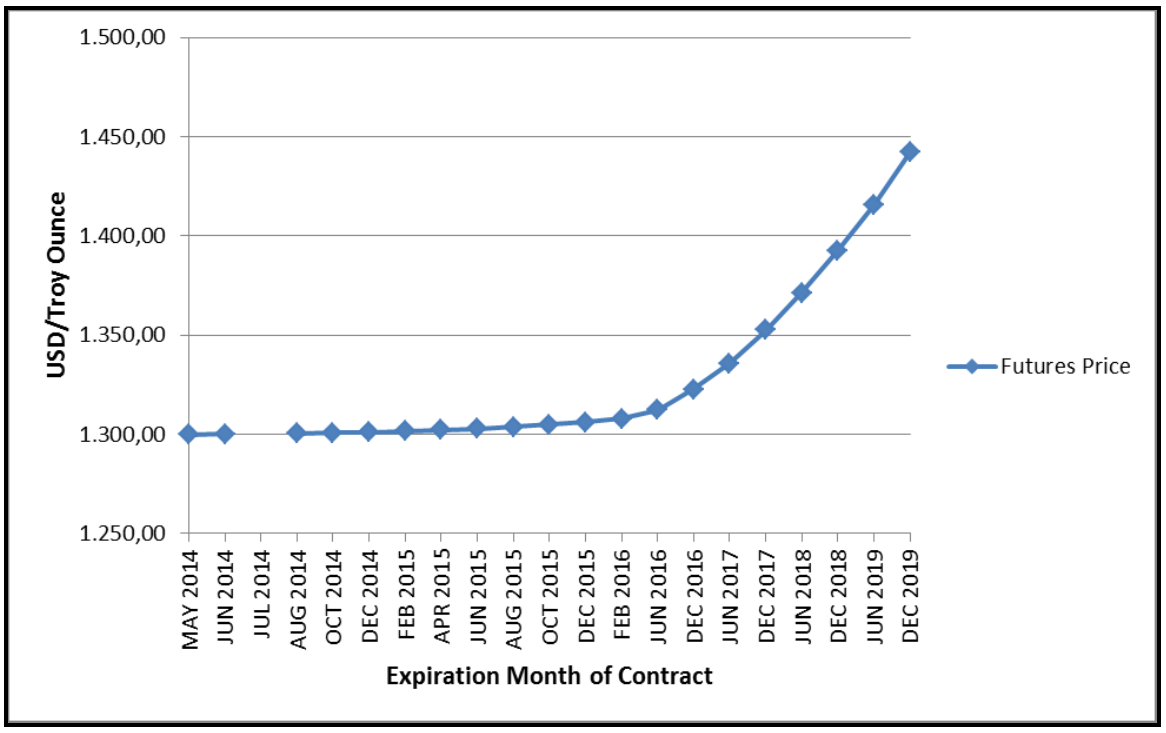

Figure XI – The futures price quote of Gold from COMEX as of the end of trading on 15.04.2014. Source: CME Group (2014b).

Crude oil is not always in a state of backwardation however and many oil products were actually in a state of contango a number of times during the years 2006-2009 for example. Brent crude oil was in a state of contango around just under 30% of the time during the period of April 1994 – February 2006, while WTI was in contango around 35% of the time from January 1991 – February 2006 according to Campbell, Orskaug, & Williams (2006).

Another reason that forward prices can lie below the spot price is the option value that oil producers have when holding oil reserves underground (Campbell, Orskaug, & Williams, 2006). This value comes about when there is uncertainty about future demand and supply producers can potentially benefit from higher prices later. This option value of holding oil in the ground makes it so that the spot price has to be higher than otherwise predicted so that the producer is indifferent to producing oil or holding it. The uncertainty only drives up the current price on the curve. This option value is similar to convenience yield except that it is on the producer side and not the consumer side.

In practice there is feedback between the forward and spot prices of oil due to the structure of the market and it is an oversimplification to only treat the formation of the forward prices as one way causation from spot prices (Fattouh, 2011). The formulas that oil price reporting agencies use to determine their benchmarks rely partly on data from the various financial layers of the oil market and prices of different types of instruments. It is important to keep in mind that the logistics of the oil price formation process complicate the relationship between spot and forward prices and that general theoretical models for commodity forward prices cannot explain the process and direction of causation of price formation completely.

3.3 Hedging for exposure to oil prices

The basic concepts of hedging and its benefits for parties in a variety of situations have been explored earlier but in this chapter, arguments for and against it will be discussed in a manner that relates specifically to the market for oil products. Crude oil prices have generally been considered to be more volatile than other commodity prices and there is evidence to support this idea. Olimb & Ødegård (2009) found that when they compared WTI and Brent oil to 11 other commodities[4] over the period 1994-2009 crude oil had a higher variance in price changes than 9 of them along with higher mean and median returns than most. However, when they looked at the period of 2003-2009 oil was not as volatile compared to the other commodities by their method, scoring only higher than three, and three showed more volatility than oil. It is worth noting that they found that volatility had not increased much for oil between the periods of 1994-2002 and 2003-2009, but the volatilities of 8 of 11 other commodities had increased significantly.

It would seem prudent for producers relying heavily on oil products to hedge their exposure to oil prices so as to decrease the chances of lower tail results in case of large inconvenient and unexpected price movements. As mentioned earlier there is evidence that hedging for various types of risk can increase firm value. With respect to hedging for fuel prices there is evidence in the United States airline industry of a positive relationship between hedging and firm value (Carter, Rogers, & Simkins, 2006), while there is also evidence to the contrary in the case of United States oil producers; their hedging activities do not increase firm value (Jin & Jorion, 2006).

By using Tobin's Q as a proxy for firm value, Carter, Rogers, & Simkins (2006) find that airlines in the United States that hedge for exposure to fuel cost risk trade at a premium of up to 10% on average (at 10% significance level though and not all tests they conducted yielded significant results). They explain that the degree of hedging matters, it is not a binary variable, and that firms can not automatically increase their

[4] Natural Gas, Coal, Aluminum, Copper, Lead, Nickel, Zinc, Tin, Silver, Gold, and Soybeans.

value simply through hedging but that firms that do engage in it face different opportunities over time depending on economic conditions. They explain the reasons for this premium could lie in the relation between fuel costs and investment environment in the airline industry. During times of low cash flows in the industry which fuel prices can cause, firms which hedge and often have relatively strong cash flows can come across bargain opportunities by investing in assets at slashed rate prices from firms in a state of financial distress. At times like these there are also often attractive takeover opportunities available which strong firms can take advantage of. External financing can also be more expensive during these times as a result of asymmetric information and this increases the importance of a strong internal cash flow even more to be able to take advantage of opportunities that arise. These factors combined can make airlines that hedge for fuel price risk more attractive to investors and can be classified as a lowering of expected underinvestment costs.

Using a similar method, Jin & Jorion (2006) come to the conclusion that hedging activities do not have an effect of firm value for oil and gas producers in the United States. They do however find that hedging activities lower the sensitivity of firms' stock price to price changes in oil and gas. There are obviously differences between distinct sectors of the economy in the use of hedging and it does not increase firm value uniformly across them. One of the main reasons given for why hedging by oil and gas producers doesn't increase firm value is that shareholders generally prefer to be exposed to oil price risk in this sector and prefer to diversify their portfolios according to their own specifications.

The fact that shareholders do not want oil producers to hedge also ties in with the reasoning Campbell, Orskaug, & Williams (2006) give against the usefulness of hedging for exposure to oil price risk for certain parties. They also mention that state oil companies generally don't hedge because they value upward movements in price more than they fear downward movements and it could look bad politically to have seemed to have lost profits on a national asset. In many cases with oil users their products are not sold in the forward market and hedging can cause competitive disadvantages in

sectors like this. If prices in a generally non-hedging industry rise and fall in accordance with the price of oil a hedger would realize lower returns than the average company if fuel prices and their product prices fall. The risk of these lower tail realizations can outweigh the benefits of the hedge in case prices rise.

To close this chapter one more example of a hedging strategy with oil products will be explored that relates to oil traders and wholesalers and retailers. According to Már Erlingsson, executive director of the fuel department at Skeljungur hf.[5] (personal interview, April 4, 2014), situations can arise when the forward curve is in contango that hedging the purchase and sale of petroleum products can directly profit the trader. If the forward curve is in such a state of contango that oil can be purchased forward at one point in time and sold forward at a later point, returns above normal market levels can be made. If the difference in prices is larger than the storage cost incurred over the period and potential interest payments, traders can profit from this difference and contango is therefore a situation that certain market participants enjoy seeing. Often when contango occurs traders tend to stock up on oil to the best of their ability due to these incentives. In essence, when this situation arises, the no arbitrage conditions on forward prices are breaking and opportunities can close fast. It is important though that delivery is made in these forward contracts or that there are separate and equal physical transactions made if the forwards/futures are not delivered. If there is no physical backing, these kinds of transactions turn from hedging activity to speculation and this can have negative payoffs.

[5] An Icelandic oil distribution company.

4 The Icelandic Market for forward oil contracts

As of the beginning of the year 2014 Iceland does not produce its own oil products and therefore they need to be imported for various uses by producers and for private consumption. Useful data exists about oil import volume by type of oil and also about who the largest users are. Figure XII outlines fuel consumption in Iceland by consumer type.

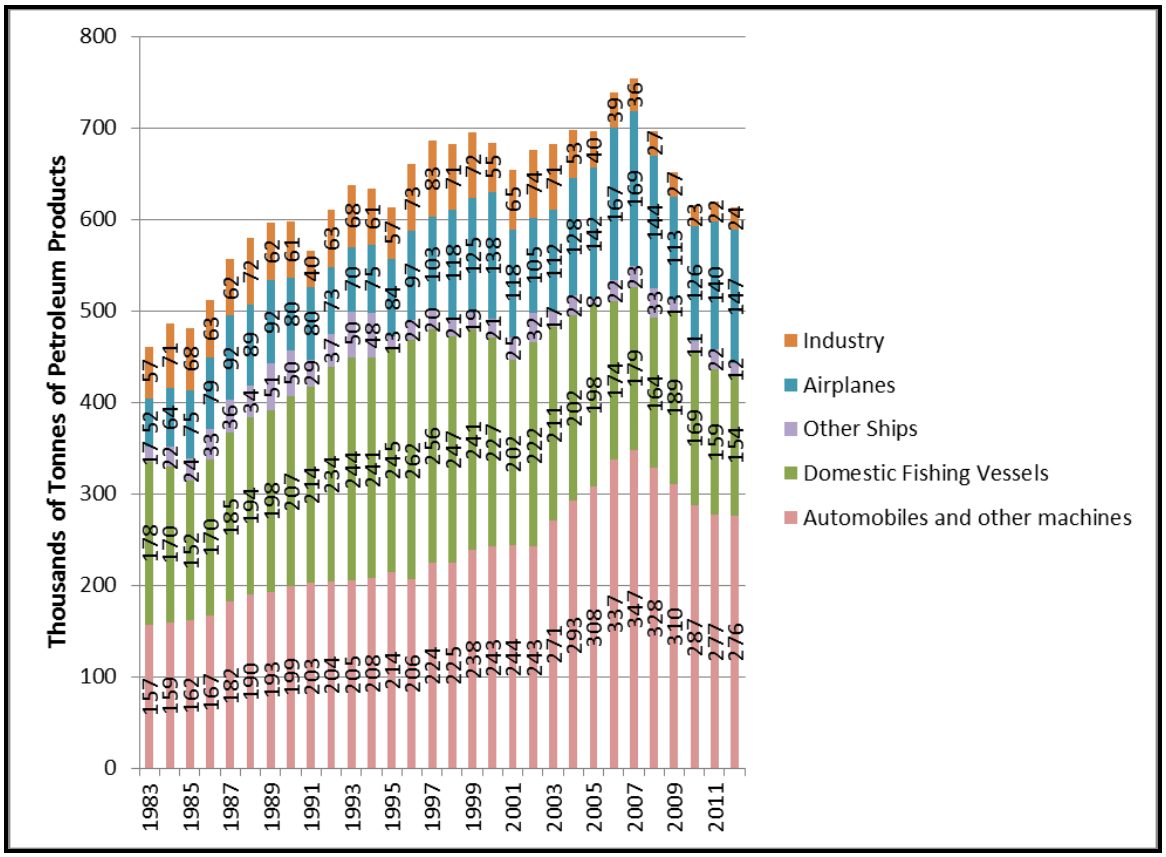

Figure XII – Oil consumption in Iceland by type of use. Source: Statistics Iceland (2014a).

As can be seen in the figure, some of the largest professional users of oil products include fishing companies and airlines, while automobiles and other machines have the largest share in recent years (this class can be split into both private and professional users).

Since one of the main objectives of this thesis was to attempt to gauge the size of the Icelandic market for forward oil contracts versus the size of the spot market, large professional users of oil were examined. The total consumption of their industries will be taken into consideration along with the fact that some have been written about in literature covering this topic. One of the main challenges in this task is gathering accurate and useful information due to the private nature of the OTC oil market. Therefore, most of the focus will be on industries with relatively large participants[6] as this method was thought likely to be the most efficient and yield a somewhat comprehensive picture of the market. The information available to draw conclusions turned out limited and was obtained from a variety of sources such as publically available annual reports, correspondences with corporate oil users and interviews with experts on the topic. The data available is not as complete as it ideally would be and unfortunately the conclusions derived from it are therefore somewhat limited. A major hindrance to the methodology of partially relying on information that is not publicly available is that the holders can potentially give away strategic information and market participants therefore cannot share it. This makes the data collection process more complicated and certain information that would be of interest is simply unavailable to use in a project of this kind.

4.1 Background information and thoughts

There are a number of factors which potentially influence the size of the Icelandic forward market for oil and a number of them will be listed here to keep in mind. As of the spring of 2014 Iceland still has capital controls in place after the financial crisis of 2008. According to article 13. b. 5. of act no. 87/1992 about matters regarding currency (amended in 2011), transactions with forward contracts, derivatives, options, currency and interest swaps, and other similar currency transactions where the Icelandic Krona is involved are prohibited across borders. At the early stages of researching this topic the expectations were that the capital controls would severely limit the extent to which firms could hedge their fuel price risk. However, article 13. i. states that transactions

[6] Airlines as opposed to contractors for example.

with derivatives for the sole purpose of purchasing goods and services are exempt from the controls and therefore legal. This means that some forms of forward transactions across borders are in fact not prohibited by the capital controls. In practice some sources using derivatives to hedge their oil price risk reported that they have exemptions from the capital controls allowing for their hedging activities, or that it makes them simpler in a logistical sense. This leads to the conclusion that while the laws don't prohibit all use of forward contracts and derivatives they do impose limits for certain kinds of transactions that don't fall under article 13. i. The controls prevent the use of derivatives as a form of investment.

Due to the partial limitations on international hedging alternatives it was expected that some sort of domestic forward market would exist between oil users and suppliers. Derivatives are not traded in the Icelandic stock exchange which is another potential limiting factor for hedging opportunities. One can also speculate whether the fact that interest rates are generally higher in Iceland than nearby countries (LIBOR vs. REIBOR) influences hedging decisions by raising the forward price curve.

Among other questions present when looking at the Icelandic market are how the forward market compares to the spot market, what factors actually influence the markets' size, if members of the market use other means to hedge, and who the main participants in the forward market are. An attempt to answer these questions will be made in the remaining chapters.

4.2 Who are the main forward market participants?

First, the role of the oil distribution companies and their role in the market will be discussed. Figure XII shows oil consumption in Iceland by type of use and it is clear that airlines and fishing companies are major oil users; therefore their role in the forward market will be discussed. Along with these companies, shipping companies fit into the *Other ships,* and *Automobiles and other machines* category and will also be examined.

Lastly, other types of companies, such as contractors and bus/tourism companies, potentially use a significant portion of the oil consumed every year, but due to their number and the presumption that they are relatively small, compared to the ones previously mentioned, they will not be afforded a separate chapter. The general guideline will be that individual companies will not be named unless further reasoning for naming them is provided.

4.2.1 Oil distributors

There are four main oil distribution companies operating in Iceland as of 2014, some of them selling petroleum products under more than one brand. The information about the methods the oil companies use to purchase and sell oil has been gathered through e-mail correspondences, publically available annual reports, and personal interviews. Information was not available about all the companies but those that provided information or had it publically available sold an estimated combined amount of over 500.000 tonnes of fuel in the year 2013 and have well over half the market share[7] in total fuel sales in Iceland.

In general the companies that provided information use similar methods of purchasing oil which resemble the long term contracts using formula pricing described earlier in this thesis and are generally used worldwide between large market participants. The companies negotiate contracts for one year at a time where the volumes to be delivered are agreed upon and the prices are variable and dependent on factors around the time of delivery including in some cases the average price of the month, week, or past month for the different types of products in question.

[7] Official figures for total fuel sales in 2013 are not available but this conclusion is reached extrapolating from publically available annual reports and by barring very significant inceases from figures shown in Figure XII for 2012.

Figure XII shows that a large portion[8] of fuel consumption is for automobiles and other vehicles and presumably much of this is by private consumers fueling their automobiles or other vehicles and paying the going rate at the pump, even though some professional use will also fall under this category. The next two largest categories are airplanes and domestic fishing vessels[9] and these are mostly professional users. In many cases professional users have contracts with the oil distributors. According to a source in the industry some of these contracts use pricing similar to formula pricing where the end user pays a price derived from a benchmark.

The prospectus of N1[10](N1 hf./Arion bank, 2013) outlines that distribution companies face the risk that oil prices can change in an undesirable manner between the time that it is purchased into inventory and sold on to the end user and this is supported by other sources as well. According to information obtained from industry sources and annual reports there are examples of the companies[11] using forward contracts to mitigate this risk.

Strategies can work in such a way that a company has to match the incoming supplies with outgoing supplies at certain periods and if this is successful the incoming and outgoing pricing systems guarantee its preferred markup. If forecasted oil sales change and don't match a shipment from the long term contract anymore the company may have to either purchase additional oil or sell excess oil at prices inconsistent with their pricing methods. Long forward positions are used if the sales forecast increases. When the forecast changes it enters into a long position to hedge the price risk of the additional oil needed and in essence fix it in place to make it consistent with its pricing methods and mitigate price risk. Short forward contracts are used if the forecast decreases. A short position guarantees that the excess oil from the long term contract

[8] 45% in 2012 and that ratio fluctuated between 43%-47% in the years 2005-2011.

[9] 25% fishing vessels and 24% airplanes in 2012.

[10] One of the distribution companies.

[11] At least one, possibly more.

can be sold at a satisfactory price at a later date. In the examples provided from the Icelandic market the forward contracts used are closed out before delivery so the payoff from the contract is used to offset price changes in physical transactions.

The contracts used in the examples available in the Icelandic market have foreign counterparties. Capital controls come into play in these transactions so there are examples of companies having exemptions from them, allowing for these hedging activities.

On the sales side the companies that provided comments had differing answers on whether they offered the option of selling oil forward to customers. There are examples of companies offering corporate customers the possibility to buy oil products at fixed prices (a form of forward contract) while others say that they do not offer this option. The companies that do offer this option use long forward contracts on their purchasing side to offset the risk they would otherwise incur in offering this option.

Information from those that offer forward sales of oil on the volume sold in this manner indicates that it is only a very small portion of their total sales and that even though many customers[12] are informed about this option they often prefer not to use it even though it could potentially benefit their operational stability. Exact figures for oil sold at fixed prices in the market are not available.

This thesis does not offer an indication of the volume of forward contracts used by the oil distribution companies and the findings are simply that they are used by some of the participants in the market in the different manners described above. No data was available about their volume of use. It is interesting to note that some companies do not offer their customers the option to buy oil at fixed prices while those that do find it to be a very small portion of their sales. This implies that most of the physical transactions with oil products are in the spot market. That being said there is an

[12] Such as contractors, coach companies and fishing companies.

example of a company using this mechanism in its oil purchases and it will be mentioned in the next subchapter.

4.2.2 Airlines

According to the Icelandic Civil Aviation Administration there are 13 entities holding air operators certificates in Iceland. Among these entities are the coastguard, domestic airlines, cargo airlines and international passenger airlines. This chapter will focus on three of them, two of which are owned by the same parent company. Due to the public nature of most of the information in this subchapter and the small size of the market the companies will be named.

WOW Air and Icelandair are the two main international airlines competing on the passenger air transport market. Icelandair is owned by Icelandair Group which also owns Air Iceland, a mainly domestic airline. These companies are presumed to have much more expansive operations and more fuel consumption than the remaining market participants due to their international nature. A ruling by the Icelandic Competition Authority (2013) indicates that at the time between June and October of 2012 Icelandair transported between 70-75% of all passengers on flights between Iceland and foreign destinations, with the company that is now WOW Air transporting between 10-15% and 9 other foreign competitors all transporting between 0-5%. These figures only look at international passenger counts so considering also Icelandair Groups cargo operations and its domestic flights it is by far the larger of the two airlines.

Both airlines use hedging strategies for their fuel costs. There is little public domain data available about WOW Air but information provided by the company indicates that it purchases some portion of its fuel at fixed prices with physical delivery from a domestic supplier. This is the only example found of use of forward contracts with delivery in the Icelandic market during the preparation of this thesis. Further

information is not available about the company's oil consumption and details concerning the structure of the contracts.

Icelandair Group uses a somewhat different approach to fuel price hedging which is outlined in a number of its annual reports published between 2007 and 2014. As outlined in these reports the company's fuel price hedging strategy relies heavily on swaps and this was further explained by Ólafur Briem, Director of Risk management (telephone interview, March 26, 2014). The company pays a fixed rate and receives a floating rate and uses foreign investment banks as counterparties. The company hedges roughly 50% of its forecasted oil consumption 6 months in advance. In addition to swaps the company mentions use of options in its reports as well. Actual physical purchases of fuel are made in the spot market.

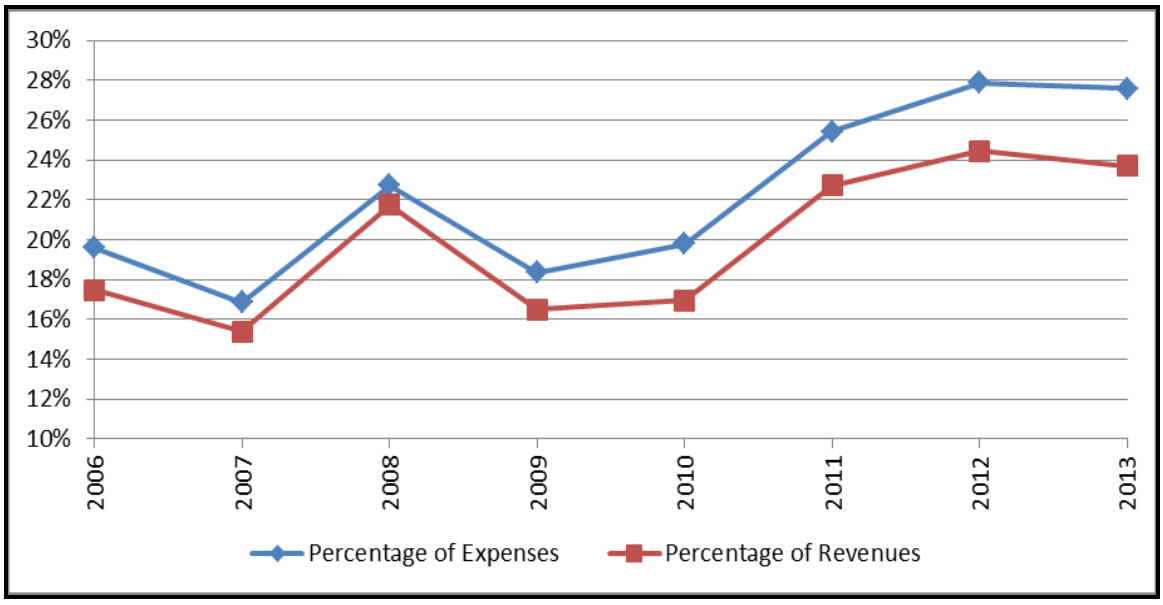

Figure XIII – Aircraft fuel costs as a percentage of revenues and expenses of Icelandair Group. Source: Icelandair Group (2008-2014).

Figure XIII outlines the percentages that fuel costs are of total expenses and revenues for Icelandair Group and in recent years they have been quite high. These proportions may or may not be representative for the airline industry but if they are they underline the importance of mitigating risk stemming from fuel prices as these proportions of total expenditures are the highest encountered in this thesis when compared to information available about other sectors.

Icelandair (excluding Air Iceland) used 207.000 tonnes of fuel in the year 2013 which is a very significant portion[13] of fuel consumption in Iceland. Since roughly half of the fuel is hedged this means Icelandair has a major impact on the amount of fuel price hedging performed in Iceland.

There are a few interesting notes to take away from specific annual reports. In the year 2008, when jet fuel prices displayed exceptional volatility the company's strategy featured put options in part due to anticipation of renewed lowering of prices after a rapid increase (Icelandair Group, 2009). The hedging strategy was altered somewhat due to unusual circumstances and the report states that it was a success of sorts. In the year 2011 the group managed to lower its fuel costs by 1.4 billion Icelandic kronas which it attributes to a mixture of its hedging activities and favorable currency effects (Icelandair Group, 2012). The net level of fuel expenses in 2011 was 22.0 billion Icelandic kronas.

4.2.3 Fishing Companies

Four of the largest fishing companies in Iceland were contacted to inquire about forward contract use and half of them replied, both stating that they did not use forward contracts as part of their oil purchases. While the market has many participants with 50 companies possessing 85,2% of the distributed quota at the start of the fishing year 2012/2013, the companies that answered the inquiry owned 17,2% (Icelandic Directorate of Fisheries, 2014). As mentioned in earlier information from the distribution companies indicates that fuel sales at fixed prices are a very small portion of

[13] No data was available about fuel consumption in Iceland for 2013 from Statistics Iceland, however looking at Figure XII there is no reason to believe that is would not be a significant portion of the total consumption barring a large unexpected change between years. Another note to make is that a part of this figure would likely not make it into the calculations of Statistic Iceland for 2013 fuel consumption as some portion of it is most likely purchased outside Iceland. While the specifications used by Statistics Iceland to calculate the fuel consumption are not available, they most likely differ somewhat from the total amount of fuel used by Icelandic entities which is a figure of greater importance to this thesis.

the total fuel sold by those offering this option. Fishing companies generally don't use this option more than others.

When looking at the information from distributors and fishing companies in tandem, there was very little evidence uncovered during the research phase of this thesis pointing towards any significant use of forward contracts in the industry. The data available is of course somewhat limited though, and does not rule out the possibility that some companies do use them.

Domestic fishing vessels have consumed a large portion of the total petroleum products used in Iceland for the last three decades and Figure XIV shows that oil costs are a relatively large portion of expenditures in the industry. While the percentages are lower than the proxy used for the airline industry they have been increasing in the last decade as global oil prices have been rising. If the assumption that Icelandic fishing companies generally don't use forward contracts is accepted the question arises why this may be.

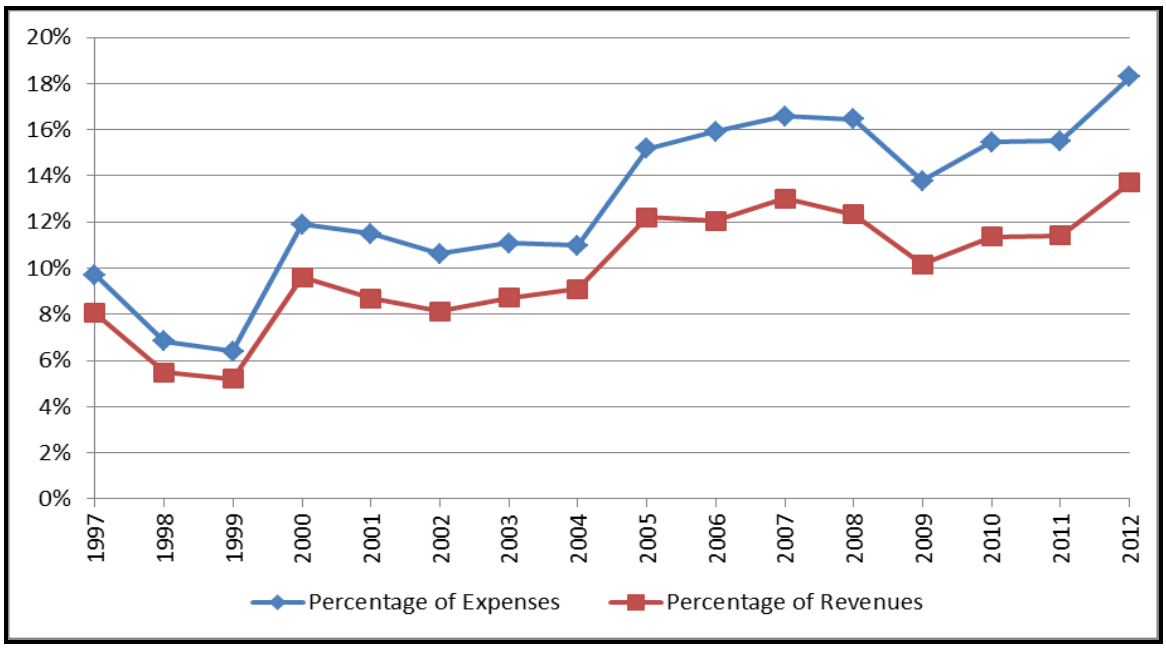

Figure XIV – Oil costs as a percentage of revenues and expenses in the Icelandic fishing industry. Source: Statistics Iceland (2014b).

4.2.4 Shipping and Transportation

According to Vilhjálmur Árnason & Þór Sigfússon (2011) there are two companies that are the most active in the Icelandic market for shipping by sea in addition to a few smaller domestic and international ones. Due to the fact that there are so few participants and the nature of information available about them, the participants will be named. The two largest companies are Eimskip and Samskip and a mixture of electronic correspondences and publically available annual reports were used to gather information about them.

In a ruling by the Icelandic Competition Authority (2007) the market shares of the companies[14] in the year 2002 are given on shipping routes between Iceland and North America, and Iceland and Europe. The market shares for Eimskip were 85-90% and 75-80% for shipping routes between Iceland and North America, and Iceland and Europe respectively. The corresponding market shares for Samskip were 5-10% and 20-25% with a company called Atlantsskip, which is no longer operational having 0-5% market share on both routes. While this information is clearly outdated and the current market shares could be very different, it indicates the market dominating size of the companies in this market and is supported by the newer claims of Vilhjálmur Árnason & Þór Sigfússon (2011).

When it comes to looking at whether forward contracts are used as a hedging tool in the industry no evidence was found to confirm their use at the time this thesis is written. Evidence was however found of forward contracts having been used in the past but it is not possible to estimate to which degree. The evidence suggests that fuel is mainly purchased in the spot market, with a significant portion being purchased abroad. A disclaimer at this point is necessary, noting that detailed information was not available about all market participants (as in other chapters) and does not rule out the

[14] The market shares mentioned are percentages of total goods shiped as opposed to percentages of revenues in the market.

use of forward contracts completely. On another note exploring Eimskip's annual report from 2012 reveals some interesting information about alternative fuel price risk management techniques in the industry. Fuel costs were 11% of the company's expenses in 2012, but the genuinely interesting part is that it applies an additional surcharge to its regular prices, called the Bunker[15] Adjustment Factor (BAF), which depends on oil prices at the time services are rendered. This surcharge isolates the company from 80% of its fuel price risk (Eimskip, 2013). The annual report makes no mention of the use of forward contracts. Samskip uses the same surcharge system according to pricing lists available in the public domain (Samskip, 2014). This method of fuel price risk management moves the risk from the shipping company to their clients.

Bunker adjustment factor is a system used internationally by shipping companies to manage their fuel price risk (Wang, Chen, & Lai, 2011). It was developed in 1974 which coincides with the time OPEC was exercising its influence in raising oil prices.

The exact volume of fuel use in the Icelandic shipping industry was not found and is potentially understated in the *Other Ships* portion of Figure XII due to volume purchased abroad. The information collected indicates that BAF is a more preferable and prevalent use of fuel price risk management than forward contracts or other derivatives in this sector.

[15] The fuel used by large ships is often called bunker fuel.

5 Results – Market Status

Before summing up the results of this assessment of the Icelandic market for forward contracts with oil products underlying it is prudent to once again point to the fact that the data available does not offer a complete picture of the market. While unfortunate, this is simply the nature of the information available using the methods utilized for information gathering. For example it is impossible to estimate the number or value of outstanding contracts in the manner exhibited for the world derivatives market in Figures I – III. It is reasonable to assume that a similar assessment of similar markets outside of Iceland would encounter similar challenges. There are however some conclusions that can be drawn from the information gathered regarding the questions posed in chapter 4.1. An explicit list of the questions is:

- What are the factors influencing the extent to which Icelandic companies use forward contracts?
- How does the use of the spot market compare to the use of the forward market?
- Do market participants use other methods to hedge their exposure to oil price risk?
- Who are the main participants in the forward market?

The most convenient way to answer these questions is in reverse order from the list, initially focusing on the last two questions in unison. Chapter 4 offers insights into these questions and a summary of the findings is as follows:

At the current time parties in two industries were found to use forward contracts, oil distributors and airlines, in addition to accounts that parties in the shipping industry have used them in the past. The volume of usage of these contracts is not available but only a binary conclusion of use or no use. Information from oil producers offering sales at fixed prices indicates that it is a small portion of their sales leading to the conclusion

that the use of forward contracts between Icelandic counterparties with physical delivery is a relatively small one.

Market participants in the airline and shipping industries do in fact use other methods in the form of other derivatives or surcharges to guard themselves against fuel price risk. The use of swaps and options was encountered in the airline industry. Relatively comprehensive information was available about certain members of the airline industry and it is of interest that derivatives are used in the manner described in the relevant chapter. Members of the shipping industry were found to use surcharges as is customary for the industry on a global scale.

No evidence of hedging or derivative use was found in industries such as the fishing industry, but this lack of evidence does not conclusively prove that they are not used at all. Further industries containing oil users were not examined, but pointing to evidence from the oil distribution industry their use of forward contracts is assumed to be negligible compared to the spot market. Again, no evidence of use is however not conclusive evidence of no use.

5.1 Size of the Forward Contract Market versus the spot market

The spot market for oil was found to be the significantly dominant fashion in which Icelandic entities make physical purchases of oil products. Exact arrangements used in spot transactions differ between private consumers, small corporate and large corporate market participants but the common thread is that most transactions cannot be classified as forward contracts.

Derivatives such as forwards and swaps without delivery were found to be used by some participants in an unknown amount with the purpose of hedging oil price risk. The irony of the situation is that even though there may be relatively few hedgers a single large user can potentially have dramatic effects on the market size in an economy

as small as the one of Iceland. Taking Icelandair for example, since they hedge roughly half of their fuel purchases and consumed 207.000 tonnes in 2013 they hedged their risk for purchases of oil making up a very large proportion of total fuel purchases in the market. This figure is not directly comparable to the numbers in Figure XII but gives an idea of the magnitudes of the transactions in question.

Limited comparisons were found between the relative sizes of spot and forward markets outside of Iceland. One example of a comparison however is the one made by Campbell, Orskaug, & Williams (2006) where they report that "at end-2005 the combined volume of oil for future delivery as indicated by outstanding futures contracts on NYMEX and ICE Futures was only 4% of that year's estimated world crude oil production." (Campbell, Orskaug, & Williams, 2006, p. 69) They also examine the turnover on futures exchanges in comparison to annual production of Oil, Aluminum, Copper, Gold and Silver in 2004 finding oil to have by far the smallest ratio. In general they state that the forward market for oil is relatively illiquid in comparison to other commodity markets. A flaw in the methodology they use is disregarding the OTC market however, and this brings in to question how relevant their estimates are in the present time, in light of this, and the fact that the market conditions may have changed since their work was published.

5.1.1 Factors Determining Market Size

The most difficult question to answer is which factors influence and determine the size of the forward market in Iceland. Ideally econometric methods would be used in an attempt to come to reliable and relevant conclusions however due to the limited data available this was not a possibility when analyzing the Icelandic market. The following are some contemplations on the subject.

Do interest rates affect the decision of Icelandic companies when making decisions whether to enter into forward contracts? According to Ásgeir Jónsson, Sigurður

Jóhannesson, Valdimar Ármann, Benaben, & Perrucci (2012) macroeconomic factors (inflation among them) in Iceland have the effect that interest rates have generally been higher in Iceland than in many western countries. In an open economy they use purchasing power parity and uncovered interest rate parity to derive the equation $I_{domestic} - I_{foreign} = \pi_{domestic} - \pi_{foreign}$ where I is the nominal interest rate and π the rate of inflation. On graphs they show that central bank rates and real interest rates have been relatively high compared to the Eurozone and the United States. The difference in the rates decreased after 2008 and the introduction of capital controls but the Icelandic rates are still higher. Given higher nominal interest rates the forward price curve should be relatively high in Iceland compared to other countries all else unchanged. A higher price of capital could potentially disincentivize hedging in Iceland compared to countries with lower interest rates.

A counter-argument to this would be that OTC derivatives markets are global in their nature and that companies can access trading in centralized hubs from all over the world (Deutsche Börse Group, 2008). Since there is no commodities exchange in Iceland this would imply that internationally competitive prices would be used by Icelandic traders. The capital controls hinder this to some extent, but this would have been true before their introduction, and is potentially true for those parties that have the ability to do business with foreign counterparties today. A valid conclusion on what role interest rates play in the level of market activity cannot be reached without further empirical analysis. One question to ask would be if changes in the general price level of forward prices would have significant effects on forward contract use. One would also have to find out if interest rates in Iceland have a significant effect on forward prices available to hedgers.

Capital controls cause some degree of limitation on the possibilities available in the forward market. While it has been shown that they do not close the international market completely to Icelandic participants, that does not mean that all forms of transactions are available for use. Forward contracts with foreign counterparties are not available for investment purposes and for some hedging applications exemptions

from the controls are needed. A comparison of pre- and post-control hedging activity could provide answers to the question of how much of an effect they have had on the market, if such a comparison were possible. Another point to factor into the equation is that in the case that exemptions are needed, applications for exemptions add additional transaction costs to the hedging process in the form of administrative fees for example. This makes the process of hedging more complicated than it would be without the controls. In general, business operations abroad by Icelandic companies are made much more complicated by the capital controls (Ólafur Briem, telephone interview, March 26, 2014).

Business models of industries have a significant effect on whether their members prefer to hedge their risk and in which way they do so. The size of industries in the Icelandic economy will affect how much forward market activity goes on. Key industries like the oil distributors differ from international oil producers in their business model and have perhaps more of an incentive to hedge. The forward nature of ticket sales in the airline industry gives it an incentive to hedge its fuel price risk to match future revenues with expenses. On the contrary, customs in the shipping industry dictate the use of surcharges instead of derivatives. The fishing industry is not a player in the forward market either and perhaps this simply has something to do with their business model and the way their revenues and expenses develop naturally over time. One example of this is the fact that the salaries of fishermen are partly dependent on oil prices. (Federation of Icelandic Fishing Vessel Owners, 2012) This should alleviate some of the negative effects of oil price changes on fishing companies, however in recent year's oil prices have been above the limits imposed in contracts rendering this clause ineffectual.

One last factor to keep in mind is the investment environment in Iceland under capital controls. In the theoretical framework relating to the interplay between firm value and hedging activities the ability for individual investors to diversify away firm specific risk reduces the effects of hedging on firm value. Given the assumption that the capital controls severely hinder Icelandic investors' ability to diversify away risk in their

portfolios, hedging activities by certain firms might increase their value in the eyes of risk averse investors and firm owners.

6 Conclusion

The assessment of the Icelandic forward market for oil is hereby concluded. It aims to introduce important concepts related to the use of forward contracts in general, concepts relating to the global market for oil and to give the reader an insight into the activity being conducted in the market in the early to middle 2010s. The constraints on data available must be considered when interpreting the results and conclusions reached and the one of the main benefits of this thesis may be the fact that it gathers information from a variety of sources into one accessible place. That being said it does answer the questions it asks to some degree and can give the reader an interesting insight into real world applications of risk management techniques in use in Iceland.

Generally speaking, the forward market is theorized to be very small compared to the spot market but it is hard to compare to other international markets which would offer valuable insight. Other methods of risk management such as swaps, options and surcharges are in use by Icelandic parties. It is interesting to see that there is a variety of methods for risk management in use and that capital controls do not significantly hinder their use.

Hopefully this thesis will give its readers some degree of insight into the activity conducted in a sector of the market they may not have been familiar with before. Those familiar with the market may hopefully be able to gain new insights.

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