

CURRENCY EXCHANGE RATE PREDICTION IN THE LONG RUN

- *THE NOK/EUR RELATIONSHIP*

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This Master's Thesis is carried out as a part of the education at the University of Agder and is therefore approved as a part of this education. However, this does not imply that the University answers for the methods that are used or the conclusions that are drawn.

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Faculty of Economics and Social Sciences

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Acknowledgement

The Master Thesis represents the end of our MSc in Business Administration program at the University of Agder. The thesis is a mandatory part of the program and correspond 30 credits. The main objective of a thesis is to apply scientific methods on a practical problem, and is intended to be related to the specialization within the study program.

Our choice of theme in this paper is based on our interest for, and educational background in financial economics. This paper has given us the opportunity to apply several aspects from courses throughout our studies. The process has, at times, been challenging and difficult. Despite this, we feel that we have achieved a richer perspective in terms of the importance and complexity of the foreign exchange markets. It has been an educational process in learning the in-depth understanding of the theoretical literature, and we are sure that we will benefit from this knowledge in the future.

We would like to use this opportunity to thank Dennis Frestad for his guidance and feedback during the process of writing this paper. We would also like to thank all of our fellow students for creating an environment characterized by motivation for learning and performance.

Kristiansand, June 2011

Mathias Lindeberg and Thomas Bergkvist Jacobsen

Summary

The purpose of our thesis is to find how to determine the NOK/EUR exchange rate in 50-80 years. In part two we present the theory we find relevant for our thesis. Initially we describe the dynamics of exchange rates and how they are determined. Further we present macroeconomic models used for exchange rate determination. Macroeconomic variables do not affect exchange rates homogenously, and therefore in part three we present the drivers of the Norwegian krone. The choice of variables is based on the knowledge we have acquired throughout our studies, and previous studies on this subject. These drivers are evaluated in terms of predictive abilities in such a time horizon required for our thesis. In part four we consider the exchange rate problem from a more superior perspective. We evaluate the current and future position of the Norwegian-, the European- and the world economy. Finally, in part five, we make our prediction regarding the NOK/EUR exchange rate in 50-80 years. Due to the availability of data and projections related to the subject, we have chosen to split the prediction into a “short term”- (2011-2020) and a “long term” (2021-2090) part.

Table of contents

Acknowledgement.....	3
Summary	4
Table of figures.....	9
1 INTRODUCTION	11
2 THEORY	12
2.1 The foreign exchange market (forex).....	12
2.1.1 Main participants	13
2.2.1 The Norwegian krone (NOK)	14
2.2.2 The euro (EUR)	16
2.3 Factors affecting exchange rates.....	16
2.4 Real equilibrium exchange rates	22
2.5 Exchange rate forecasting	22
2.6 Interest Rate Parity theory (IRP)	24
2.7 Purchasing Power Parity (PPP)	26
2.8 Balance of payments	28
3 DRIVERS OF THE NORWEGIAN KRONE	31
3.1 The petroleum industry.....	31
3.1.1 Impact on the Norwegian economy	31
3.1.2 The Government Pension Fund Global (GPF)	34
3.1.3 The oil price and the impact on the NOK	34
3.2 Interest rate differential	36
3.3 The stock market and the Norwegian krone.....	39
3.4 Economic shocks	41
4 GLOBAL MACROECONOMIC FACTORS	42

4.1 The Norwegian economy	42
4.1.2 The Norwegian oil reserves	43
4.1.3 The scaling down of the petroleum industry	45
4.1.4 Ageing of the population and challenges in the labor market	47
4.1.5 The Eurozone as a trade partner	48
4.2 The Eurozone.....	49
4.2.1 The debt crisis in the European Union	49
4.2.2 Trade in the EU and the Eurozone	51
4.2.3 Projections on future economic growth	52
4.3 The world economy.....	54
4.3.1 The American economy.....	55
4.3.2 Emerging markets.....	56
5. PREDICTION	59
6 CONCLUSION	67
Bibliography.....	68

Table of figures

Figure 2.1: Trade volume in the stock markets vs. the forex market.	13
Figure 2.2: Trade Weighted Index (TWI) for the NOK.	15
Figure 2.3: Supply and demand for NOK/EUR.	17
Figure 2.4: Impact of interest rates on exchange rates.	20
Figure 2.5: The Current account and exchange rates.	29
Figure 2.6: Norwegian Current account surplus (% of GDP).	30
Figure 3.1: The NOK/SEK exchange rate from 1967-2010.	32
Figure 3.2: Norwegian foreign trade.	33
Figure 3.3: VIX vs. NOK TWI-correlation and the oil price vs. NOK/EUR relationship.	35
Figure 3.4: The NOK/EUR relationship versus the interest rate differential.	38
Figure 3.5: The TWI exchange rate vs. the S&P 500 Index.	39
Figure 3.6: The NOK/EUR exchange rate vs. the S&P 500 Index.	40
Figure 4.1: Petroleum production from 1995-2010.	43
Figure 4.2: Gross debt PIIGS and Norway.	50
Figure 4.3: Projected GDP growth for the Eurozone.	53
Figure 5.1: Estimated GDP for Norway and the Eurozone.	62
Figure 5.2: Projected growth in GDP for Norway and the Eurozone.	65
Table 2.1: GDP at PPP for Norway, Germany and USA.	27
Table 4.1: SSB prognosis.	45
Table 4.2: Total Norwegian exports and imports.	48
Table 4.3: European exports to the world.	52
Table 5.1: NOK/EUR drivers from 2011-2021.	60
Table 5.2: NOK/EUR drivers from 2021-2090.	63

1 INTRODUCTION

The objective of our thesis is to predict the currency exchange rate between the Norwegian krone and the euro, in the long run. The motivation for our choice of subject is Agder Energi and hydropower plants. Hydropower plants have a life expectancy of 50-80 years, and the power that Agder Energi produces is traded at NASDAQ OMX Commodities Europe (known as Nord Pool), denominated in euro. When Agder Energi values the future cash flow from a power plant, the company needs to exchange the revenues from euro into NOK. In such a case, Agder Energi would benefit from knowledge about the NOK/EUR exchange rate throughout the plant's life time.

Due to future cash flows being denominated in euro, Agder Energi and other multinational companies (MNC's) are exposed to a substantial currency risk (Agder Energi 2010). Being able to forecast exchange rates is therefore important, not necessarily to earn profits, but more to implement policies (Madura and Fox 2007).

Due to the long time horizon, we have chosen a theoretical approach to our problem, rather than a more complex econometrical analysis. This is mainly because of the uncertainty and complexity associated with exchange rate prediction. Our goal is to predict a possible trend for the NOK/EUR exchange rate for the next 80 years.

2 THEORY

2.1 The foreign exchange market (forex)

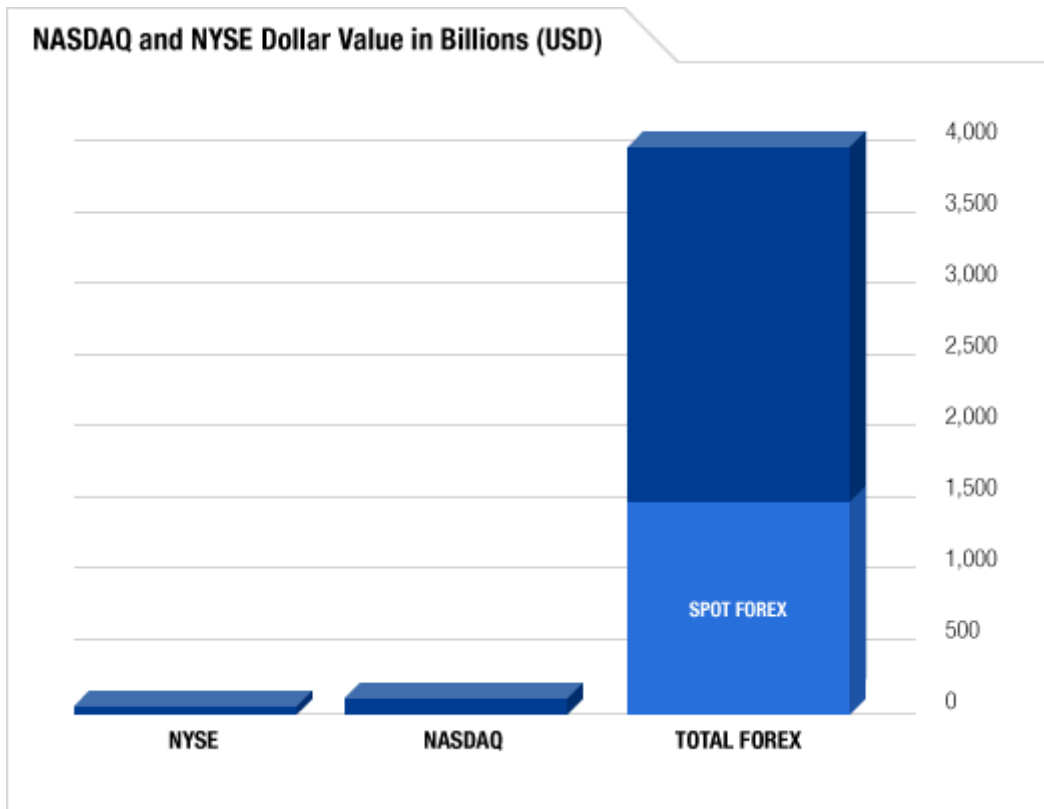
The foreign exchange market is the world's largest and most liquid financial market (XE 2011). According to fxTRADE¹, there is a volume of around 4 trillion U.S. dollars being traded daily, where around 1.5 trillion is spot trading (fxTRADE 2011). This is the market where individuals, firms, and banks buy and sell foreign currencies. The foreign exchange market is not located in a specific city or country, but comprised of all the locations where a currency such as the Norwegian krone is exchanged for other currencies. These are different monetary centers which are connected electronically and are in constant contact with one another. All the monetary centers form a single international foreign exchange market. The spot currency market is open 24 hours a day, five days a week (XE 2011).

The figure below shows the differences in trade volume between the foreign exchange market and NYSE/NASDAQ². As we can see, stock markets are traded at a significantly lower level than the foreign exchange market.

¹ fxTRADE, O. (2011). "Benefits of Forex Trading." Retrieved 22.01., 2011, from <http://fxtrade.oanda.com/learn/intro-to-currency-trading/benefits/trading>.

² New York Stock Exchange/ National Association of Securities Dealers Automated Quotations

Figure 2.1: Trade volume in the stock markets vs. the forex market.



Source: (fxTRADE 2011)

2.1.1 Main participants

The most important actors in the foreign exchange market can be divided into four groups (Federal Reserve Bank of New York 2011).

Foreign exchange dealers:

These are commercial- and investment banks, and other financial institutions such as insurance companies. This group plays a dominant role in the exchange market and is the major dealer in the interbank market.

Financial and non-financial customers:

These are smaller financial institutions that are in need of foreign currency due to foreign investments and other purchases (goods and services etc.)

Central banks:

To some degree, all central banks participate in their nations' foreign exchange markets. The activity level varies from country to country, but central banks play an important role. The purpose with this intervention can be that the central bank may seek to accumulate, reallocate among currencies, or simply reduce their foreign exchange reserve balances.

Brokers:

The broker operates as an intermediary between the buyer and the seller in a trading-process. The broker must keep in close touch with the dealers and know the rates at which market participants want to buy and sell. This implies that the broker needs to know all available information in the market.

2.2.1 The Norwegian krone (NOK)

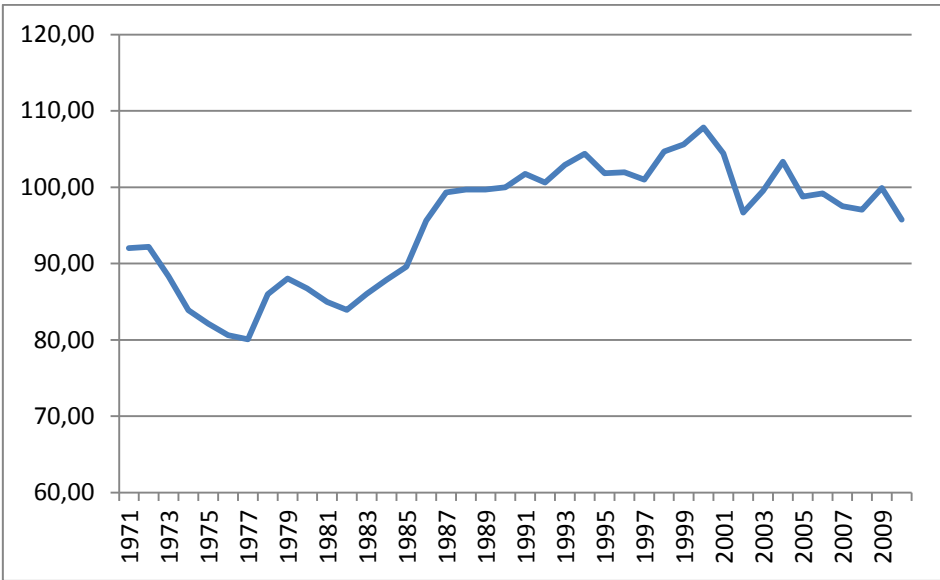
The Norwegian krone was introduced in 1875 and replaced what the Norwegians referred to as *speciedaleren*. The introduction of NOK led to Norway joining the Scandinavian Monetary Union. Although this union was dissolved in 1914, Norway decided to keep the name for their currency. Norway has a floating exchange rate, which is regulated by supply and demand in the international foreign exchange market (Norges Bank 2010).

Every third year Norges Bank conducts a survey where the purpose is to look at the activity level for the Norwegian foreign exchange market. This is done in co-operation with Bank for International Settlements (BIS). Central banks and financial institutions all over the world participate in this survey, which gives important information about the activity in the foreign exchange- and the derivatives market. This makes it easier for central banks, governments and other market participants to see how the markets change over time. The average daily turnover in the Norwegian foreign exchange market was 22 million US dollars in April 2010, compared to 32 million US dollars in April 2007. This amount exchanged into NOK, results in a decrease of 61 billion NOK. BIS also reported that Norwegian banks had lost some of

their market share, falling from 0.7 percent to 0.4 percent from April 2007-2010 (Norges Bank 2010).

The graph below shows what is called the *trade weighted exchange rate* for the Norwegian krone, referred to as the TWI. This is the nominal effective krone exchange rate calculated on the basis of NOK exchange rates against the currencies of Norway’s 25 most important trade partners (geometric average using OECD’s trade weights). In 1990, the index was set to 100. A rising index indicates a depreciated krone, while a falling index indicates an appreciated krone (Norges Bank 2011).

Figure 2.2: Trade Weighted Index (TWI) for the NOK.



Source: (Norges Bank 2011)

Estimates done by SSB (January 2011) indicate that since the 1990’s, the NOK has appreciated less against countries that Norway export goods to than countries that Norway import goods from. SSB argues that the NOK’s international purchasing power is more strengthened than the industry’s international competitiveness is weakened (SSB 2011).

2.2.2 The euro (EUR)

Euro is the official currency in the Eurozone. The currency was introduced as a virtual currency in 1999 and as physical currency in 2002. Today 17 out of 27 countries in the European Union use the euro as their domestic currency. This makes the euro one of the most important currencies in the world. (European Commission 2011).

When the European Union was founded in 1957, one of the goals was to create a ‘common market’ for the member states. As time went by, the conclusion was that if markets were to be effective, something had to be done with the currency. The thought was that a single currency would integrate the members and make it easier in terms of economic and fiscal policies. Though each national government is responsible for fiscal policies such as tax and spending, the European Central Bank makes policies for inflation, stability, growth and employment (European Commission 2011).

There are several advantages with having a single currency for the Eurozone. It makes the markets more efficient, cuts transaction costs, international trade is made easier and it gives the European Union a more powerful role worldwide. The size of the Eurozone also makes the euro less vulnerable to economic shocks, and gives the people a stronger European identity (European Commission 2011).

2.3 Factors affecting exchange rates

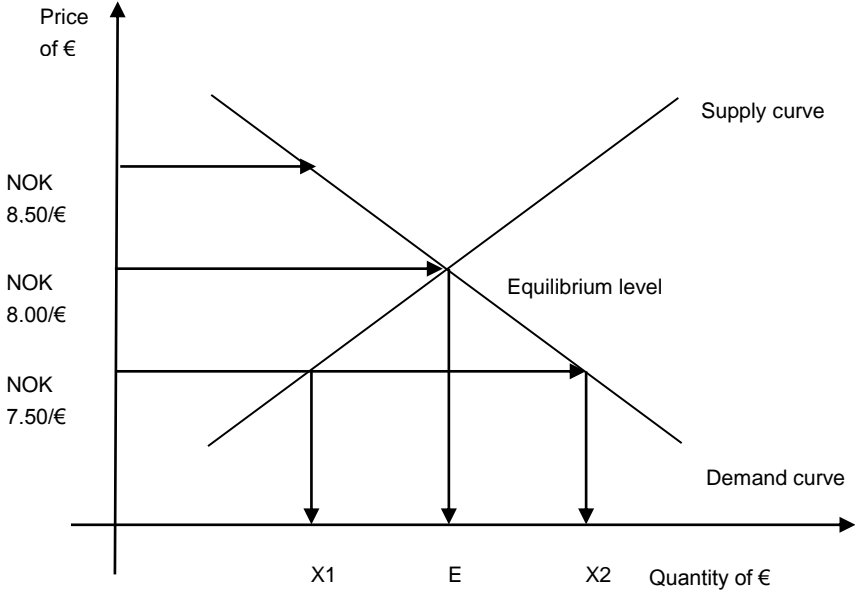
In this part we will present the macroeconomic factors that are considered to be the drivers of exchange rates. We believe this is useful for the purpose of understanding the dynamics of exchange rates. To illustrate how the different factors influence exchange rates, they will be considered at *cet. par.* (all else equal). In reality all factors are inflicting pressure on exchange rates simultaneously, though their impact changes continuously (Madura and Fox 2007).

Exchange rates are like the price on any other products, determined by the level of supply and demand. If there is a high demand for a given currency relative to another, the price of this currency will increase, and conversely decrease if the demand is low. When demand meets supply, the exchange rate is in an equilibrium state, and there will be no surplus or shortage in

currency supplied or demanded. Exchange rates will not remain at the same equilibrium point over time, but will continuously keep moving, reflecting the changes in supply and demand. In our thesis we are discussing the relationship between NOK and EUR, and we will therefore use this exchange rate (NOK/EUR) in the forthcoming examples and discussions.

The supply/demand relationship is illustrated with random figures in the graph below. When the price of euro drops from NOK 8.00/EUR to NOK 7.50/EUR, demand for euro increases. At this price level there is a substantial gap between euro supplied (X1), and euro demanded (X2). A price of NOK 7.50/EUR at this supply- and demand level, would not be sustainable. The price of euro will therefore converge towards the equilibrium level (E), where supply equals demand.

Figure 2.3: Supply and demand for NOK/EUR.



Source: (Madura and Fox 2007)

The equilibrium price level, and the level of quantity supplied and demanded, changes continuously. According to Madura and Fox (2007) these changes can be explained by changes in the following five macroeconomic variables, and summarized in the equation as follows:

$$e = f(\Delta INF, \Delta INT, \Delta INC, \Delta GC, \Delta EXP)$$

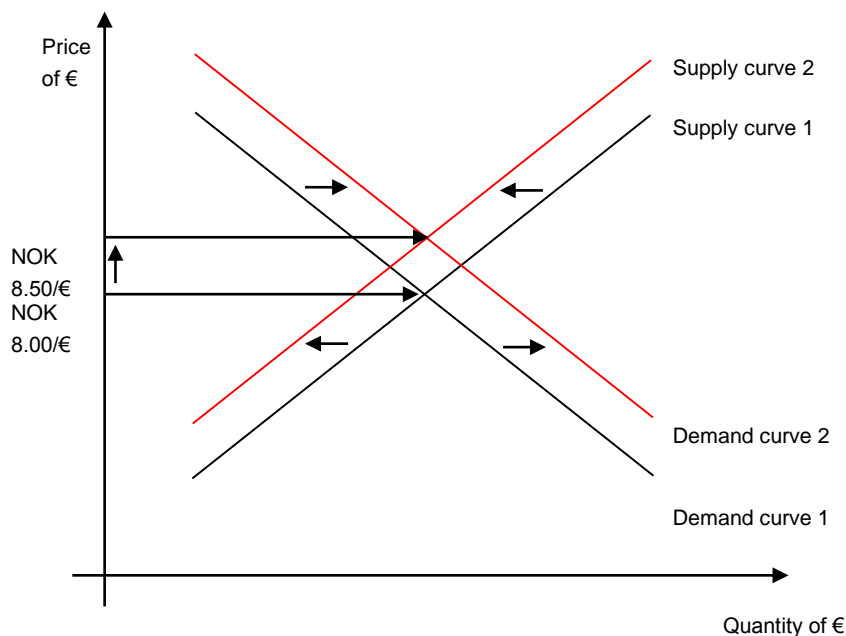
- e , represents the percentage change in the spot rate
- ΔINF , represents the change in inflationary differential between two countries (currencies).
- ΔINT , represents the change in interest rate differential between two countries.
- ΔINC , represents the change in the income level differential between two countries.
- ΔGC , represents the change in government control.
- ΔEXP , represents the change in future currency value expectations.

Inflation:

Inflation is defined as “*continuous growth in the general price level. Inflation is the same as a drop in the value of money, meaning that at a given amount of money one would get fewer goods than before.*” (Norges Bank 2011). This means that the purchasing power of a unit of currency is diminishing as long as there is inflation. If there was to be a sudden jump in the inflation level in Norway relative to the Eurozone, the price of goods in Norway would increase relatively to the Eurozone. The relatively higher price level in Norway would result in Norwegian consumers increasing their demand for Eurozone goods, and consequently increase the demand for euro. On the other side, Norwegian goods will be less attractive for the Eurozone due to the higher price level, and therefore reduce the supply of euro wanting Norwegian kroner. As inflation increases in Norway, the demand for euro increases while the supply decreases, illustrated by the shifts in the supply and demand curves. Changes in the supply and demand curves results in a shift in the equilibrium exchange rate, in this case from NOK 8.00/EUR to NOK 8.50/EUR, hence the NOK depreciates against the euro (Madura and Fox 2007).

The inflation rate is the basis of the Purchasing Power Parity theory (PPP), a theory used for exchange rate determination. PPP will be further discussed in part 2.7.

Figure 2.4: The impact of inflation on exchange rates.



Source: (Madura and Fox 2007)

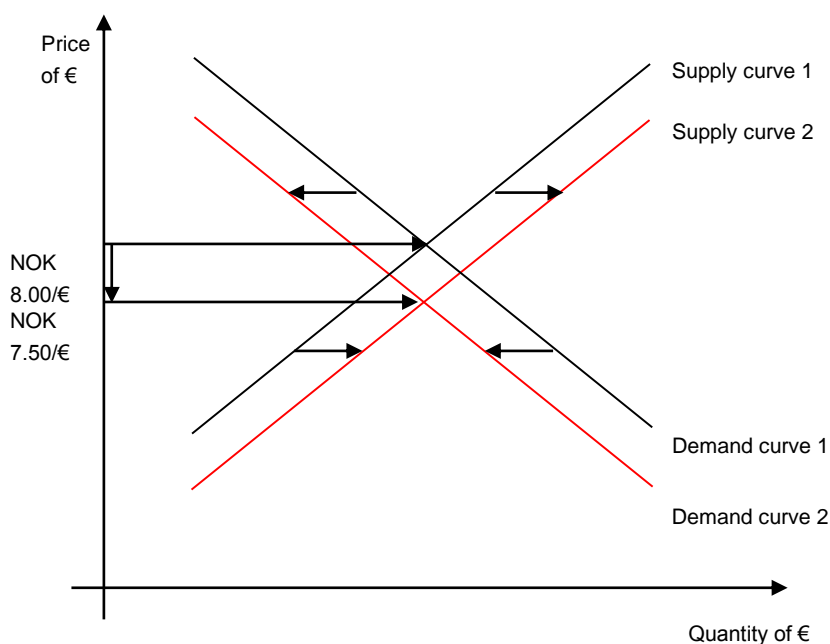
Interest rates:

Interest rates are one of the main tools used by central banks to control and regulate a nation's economy. It is also one of the main drivers of a country's currency.

If the interest rate level in Norway was to suddenly increase relatively to the Eurozone, this could have an impact on Eurozone investments in Norwegian interest-bearing securities. A relatively higher yield on investments in Norway would therefore increase the Eurozone's demand for NOK. The NOK supply would decrease as there is a stronger incentive for Norwegian investors to make their investments domestically versus investing in the Eurozone.

The exchange rate shifts from the equilibrium price of NOK 8.00/EUR to NOK 7.50/EUR, as a consequence of the relatively higher interest rate level in Norway. The NOK appreciates against the euro.

Figure 2.4: Impact of interest rates on exchange rates.



Source: (Madura and Fox 2007)

According to Madura and Fox (2007), exchange rates between two countries can also be affected by changes in the interest rate level of a third country. If the US interest rate level suddenly increased significantly compared to Norway and the Eurozone, euro investors would shift their investments from Norwegian to US interest-bearing securities. The demand for NOK would consequently be reduced, resulting in a downward pressure on the NOK (Madura and Fox 2007).

The interest rate as a tool for exchange rate prediction is further discussed in part 2.6, under the interest rate parity theory. Interest rate differentials are considered to be one of the main drivers of the Norwegian krone, and will be further discussed in part 3.2.

Income levels:

A country's relative income level (national income) is mentioned as a third factor by Madura and Fox (2007). This is because income can affect the amount of goods imported. If the real income level (adjusted for inflation) in a country increases, so will the consumption of goods.

A fraction of the increased consumption is likely to reflect an increase in demand for foreign goods (marginal propensity to import). The *cet. par.* effect is an upward pressure on the foreign currency.

An increase in the relative income levels and the subsequent increase in consumption could cause the economy to overheat. To prevent overheating and increased inflation, central banks can increase interest rates. From this we have that increased income levels can affect interest rates and inflation, which can influence exchange rates (Madura and Fox 2007).

Government control:

Madura and Fox (2007) argue that governments can influence their country's exchange rate by imposing foreign exchange barriers, foreign trade barriers, or by market intervention.

Governments can intervene in the market either *directly*, or *indirectly*. If Norwegian exports need a boost, Norges Bank could intervene in the foreign exchange market, forcing the currency to depreciate by flooding the market with NOK (increasing the supply). This would lead to a downward pressure on the value of the NOK. To strengthen the NOK value, Norges Bank could use their foreign currency reserves to purchase NOK. The effect of direct interventions depends on the amount of reserves available to the government, which need to be considerable to have an impact.

If the government intervene indirectly, it will try to affect the exchange rate by influencing the underlying macroeconomic factors like inflation, interest rate level, income level, government control and expectations on future exchange rates (Madura and Fox 2007).

Expectations:

The foreign exchange rate market respond to new information in the same way as the stock markets do. If a company publishes a financial statement that outperforms the market expectations, the stock price will be affected immediately, adjusting to the new unexpected information. The new stock price reflects the current expectations of the future value of the company. An announcement of a high inflation level in Norway, if unexpected, could cause traders to sell the NOK due to expectations of a lower future value (Madura and Fox 2007).

The impact of, and sensitivity to different macroeconomic variables on a nation's currency is not homogenous. I.e. the NOK can react differently to changes in some variables, than for

example the euro. In part three we will assess what is considered to be the drivers of the Norwegian krone, and how they influence its value.

2.4 Real equilibrium exchange rates

Exchange rates can be divided into *nominal*- and *real* exchange rates. The nominal exchange rate is a variable where inflation and purchasing power have not been taken into account. The real exchange rate can be defined as the nominal exchange rate adjusted by the relative price level between domestic and foreign goods and services (Q. Farooq Akram 2003).

The equilibrium real exchange rate can be used as a benchmark for investors who want to find out whether the real exchange rate is too strong or too weak. A higher domestic inflation or an appreciation in the nominal exchange rate against other countries, could lead to a stronger real exchange rate. This can result in a weaker competitiveness in terms of trade, and lower economic activity. A depreciation could lead to the opposite (Q. Farooq Akram 2003).

2.5 Exchange rate forecasting

Madura and Fox (2007) presents some techniques that MNC's use to forecast how exchange rates will move in the future.

Technical forecasting:

This technique uses historical exchange rates to predict future values based on patterns in past prices. There is a general opinion among academics that this approach should not be supported, because it is believed that exchange rates react to information and not past price movements. The media often speculate that an exchange rate has decreased "as a result of a three days' upward movement". This does not necessarily mean that the exchange rate has fallen back because of a certain pattern, but this can be a random movement. Although it seems to be disagreement on whether exchange rates move in a pattern, technical forecasting is popular in practice.

Fundamental forecasting:

Fundamental forecasting is based on fundamental relationships between economic variables and exchange rates.

The following factors are important for fundamental analysis:

- Inflation
- Interest rate
- Income level
- Government control
- Expectations of future exchange rates

MNC's can compare the changes and differences in these macroeconomic variables between two countries, and develop projections about the exchange rate. The historical impact these variables have had on the currency value can also be important. These projections are based on subjective reviews or on quantitative analysis such as regression analysis. Using regression analysis, one can examine if any of the variables are significant, and if they have any impact on the exchange rates.

Market-based forecasting:

This technique is a process of developing forecasts from market indicators. It is based on the spot rate or the forward rate.

A random walk:

This model is based upon the thought that all relevant information regarding movements in the exchange rates in the future, would reflect the current exchange rate. Anything that could happen in the future which influence exchange rates is only random.

2.6 Interest Rate Parity theory (IRP)

IRP can be divided into *covered interest parity* and *uncovered interest parity*. Pugel and Lindert (2000) define covered interest parity as; “a currency is at a forward premium (discount) by as much as its interest rate is lower (higher) than the interest rate in the other country.” Uncovered interest parity is defined as; “a currency is expected to appreciate (depreciate) by as much as its interest rate is lower (higher) than the interest rate in the other country.” (Pugel and Lindert 2000).

To understand IRP, we need to briefly review the concept of *covered interest arbitrage*. Covered interest arbitrage is basically a way of making a risk free profit, by capitalizing on interest rate differentials between countries. The investor invests his money in foreign securities, which provide a higher yield than what is provided domestically, while simultaneously entering a forward contract.

To illustrate the dynamics of covered interest arbitrage, let us assume that the Norwegian and the Eurozone interest rates are 4% and 6% respectively. Spot rate (S) is NOK 7.50/EUR and the one-year forward rate (F) is NOK 7.45/EUR. An arbitrageur³ purchases EUR 10,000, and invests at 6% in the Eurozone. Knowing that in one year he will receive (EUR 10,000 * 1.06) EUR 10,600, he enters a long one-year forward contract, selling EUR 10,600 at NOK 7.45/EUR, and receiving NOK 78,970. If the NOK equivalent of EUR 10,000 had instead been placed in Norway at 4%, the payment would have been NOK 78,000 in one year, hence the arbitrageur would have made a net profit of NOK 970. Covered interest arbitrage will not be allowed for more than a very short period of time. Market forces will make the forward rate adjust. This offsets the interest rate differential, and eliminates any arbitrage possibilities shortly after they are revealed. The market will eventually end up in an equilibrium state where covered interest arbitrage is no longer possible, referred to as *interest rate parity* (IRP). IRP suggests that the forward rate will adjust according to the formula below, trading at premium or discount depending on the interest rate differential.

$$p = \frac{(1+i_h)}{(1+i_f)} - 1$$
, where i_h represents the home country interest rate, while i_f represents the foreign country interest rate.

³ An arbitrageur profits on price inefficiencies in the market

$p > 0\%$ implies that the home currency (NOK in this case) should appreciate. $p < 0\%$ implies that the home currency should depreciate.

According to IRP the one-year forward NOK should have been traded with a discount of:

$$p = \frac{1.04}{1.06} - 1 = -1.8868\% \text{ at NOK } 7.3585/\text{EUR}.$$

To understand the difference between the covered- and the uncovered interest rate parity, we will illustrate how an investor can exploit uncovered interest rate parity⁴. Let's assume that a Norwegian investor receives an amount (Y) of a foreign currency, and that he does not need NOK until next year. He places this amount in the foreign country to an interest rate (i^f). After a year he will change this into NOK, at an expected spot rate (E).

$$1 \text{ Amount received} = Y \times E \times (1+i^f)$$

Alternatively, the investor can change the amount of foreign currency into NOK today and receive the domestic interest rate i^h .

$$2 \text{ Expected return in } (i^e) \text{ NOK} = \frac{(E \times 1+i^f - S)}{S}, \text{ where } S \text{ is the spot exchange rate.}$$

The theory of uncovered interest rate parity says that the domestic interest rate should equal the foreign interest rate adjusted for expected changes in the exchange rate. This should imply that $i^e = i^h$.

$$(3) i^h = i^f + \left(\frac{E-S}{S}\right) \times (1+i^f)$$

Uncovered interest rate parity for a period of d days is

$$(4) i^h = i^f + \left(\frac{E-S}{S}\right) \times \left(\frac{360}{d}\right)$$

We can conclude that the difference between the covered- and the uncovered interest rate parity is that the forward rate (F) is replaced with an uncertain expected future exchange rate (Håland 2003). Uncovered interest rate parity implies that one combines covered interest parity with an assumption that exchange rates are driven, at the margin, by risk neutral market participants who are ready to take uncovered spot or forward positions whenever the forward

⁴ The example is retrieved from Håland, J. (2003). Holder udekket renteparitet.

rate is different from the expected spot rate (Isard 2006).

It is however hard to test empirically whether uncovered interest rate parity holds, because it is difficult to measure the exact expectations of the future spot rates. We will come back to empirical studies about interest rate differentials in part three, where we take a closer look on how this has affected the Norwegian krone.

2.7 Purchasing Power Parity (PPP)

The purchasing power parity is based on the law of one price⁵ (Krugman and Obstfeld 2006), and argues that a basket of similar goods will sell at the same price in two countries, when measured in a common currency (Krugman and Obstfeld 2006). PPP was already discussed in the 16th century Spain, and is one of the oldest theories on exchange rate determination. The Swedish economist Gustav Cassel revived the theory in the 1920's in his discussions on exchange rates and price levels. At the time, WWI had brought exchange rates off their prewar values and had brought varying percentages of inflation to different countries (Cunningham 2005).

When measuring and ranking a nation's GDP, the numbers provided are often given *at purchasing power parity*⁶, as shown below for Norway, Germany and USA (CIA 2011).

⁵The **Law of one price** states that in a competitive market, if two goods sold in different countries are identical, they should sell for the same price when measured in a common currency. No transaction costs are assumed.

⁶"A nation's GDP at purchasing power parity (PPP) exchange rates is the sum value of all goods and services produced in the country valued at prices prevailing in the United States"

Table 2.1: GDP at PPP for Norway, Germany and USA.

	GDP (PPP)	GDP - per capita (PPP)
Norway	\$276.4 billion (2010 est.)	\$59,100 (2010 est.)
	\$272.3 billion (2009 est.)	\$58,400 (2009 est.)
	\$276.2 billion (2008 est.)	\$59,500 (2008 est.)
Germany	\$2.96 trillion (2010 est.)	\$35,900 (2010 est.)
	\$2.857 trillion (2009 est.)	\$34,700 (2009 est.)
	\$2.998 trillion (2008 est.)	\$36,400 (2008 est.)
United States	\$14.72 trillion (2010 est.)	\$47,400 (2010 est.)
	\$14.33 trillion (2009 est.)	\$46,700 (2009 est.)
	\$14.72 trillion (2008 est.)	\$48,300 (2008 est.)
	<i>note: data are in 2010 US dollars</i>	

Source: (CIA 2011)

The PPP theory is generally discussed in the *absolute form*, and the *relative form*.

The *absolute form* assumes perfect markets, with no transaction costs, and no international trade barriers. It argues that a basket of similar goods will have the same price, regardless of country, when measured in a common currency.

The *relative form* is closer to the “real world”, accounting for transaction costs and trade barriers. If there is a domestic price jump, demand for domestic goods will not shift from domestic to foreign markets until the benefits exceed the costs of import. Prices at PPP will, unlike for the absolute form, not be equal in every country, but the range of which the price level fluctuates within, will stay the same.

For the relative form of PPP, Madura and Fox (2007) presents the following formula for exchange rate determination:

$$e_f = \frac{1+I_h}{1+I_f} - 1, \text{ where } e_f \text{ represents change in value of foreign currency, } I_h \text{ home inflation and } I_f \text{ foreign inflation.}$$

To illustrate, let us assume a Norwegian inflation level (I_h) of 2.5%, and a Eurozone inflation level (I_f) of 3.5%:

$$e_f = \frac{1+0.025}{1+0.035} - 1 = -0.01$$

To offset the increase in the Eurozone price level and re-establish equal purchasing power, PPP suggests that the euro should depreciate by 1% against the NOK.

The purchasing power parity is based on the proposition that there is a long term relationship between inflation, price levels, and exchange rates. A relatively higher price level in a country vs. another is not sustainable over time, and market forces will force purchasing power to be equal either through changes in nominal prices or in the exchange rate. PPP is generally dismissed in the short run by economists, but is generally acknowledged to hold in the long run. Empirical tests by (Akram 2000) and (Papell and Prodan 2003) finds evidence for PPP to hold in the long run for Norway.

2.8 Balance of payments

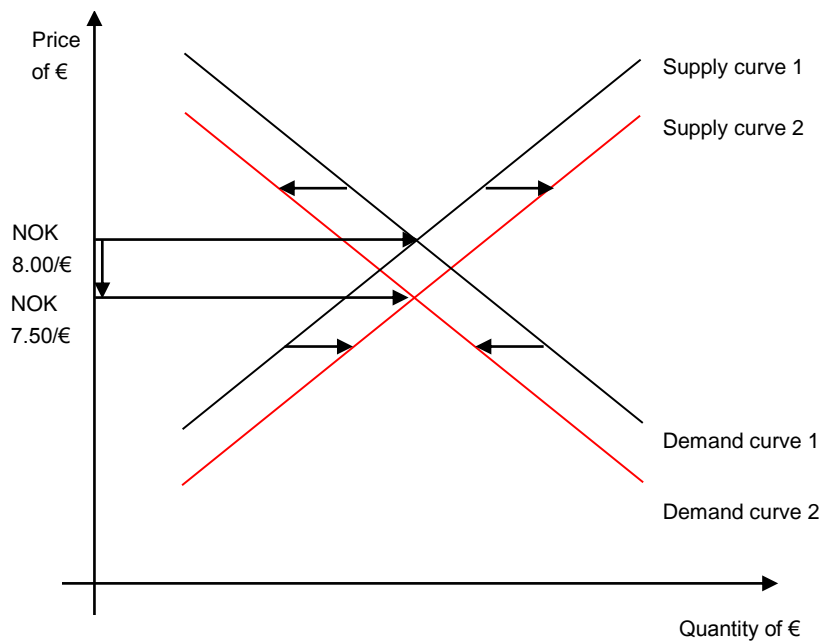
Globalization has made international trade more effective and more important over the last decades. Countries import and export different goods and services from all over the world. Every country cannot produce the same products. Factors such as availability of natural-resources, costs of labor, wealth and knowledge vary across the world. Countries develop what economists refer to as absolute- and comparative advantages. This can explain why countries import some goods and, export others.

Balance of payments is a result of the globalization and involves summary statements which include imports and exports for a country during a period. The biggest factor in a nation's balance of payments is the cash that flows in and out as a result of imports and exports (current account). Balance of payments also include other cash in- and outflows, like cash received from a foreign investment, loans, foreign aid, tourism, and military expenditures (Salvatore 2004).

The current account is closely linked to the value of a country's currency. It measures a nation's net export of goods and services. If a country imports more goods and services than they export, there will be a deficit on the current account. This can have an impact on the value of the country's currency. Let's assume that the current equilibrium price for the NOK/EUR in the foreign exchange market is NOK 8.00/EUR. If the Eurozone export less than they import, there will be a shift in the demand curve due to foreign nations demanding

less euro. The Eurozone needs to sell euro to buy the foreign goods, hence there will be a shift in the supply curve. Shifts in the supply and demand curves, result in a new equilibrium price of NOK7.50/EUR (Holden 2007).

Figure 2.5: The Current account and exchange rates.



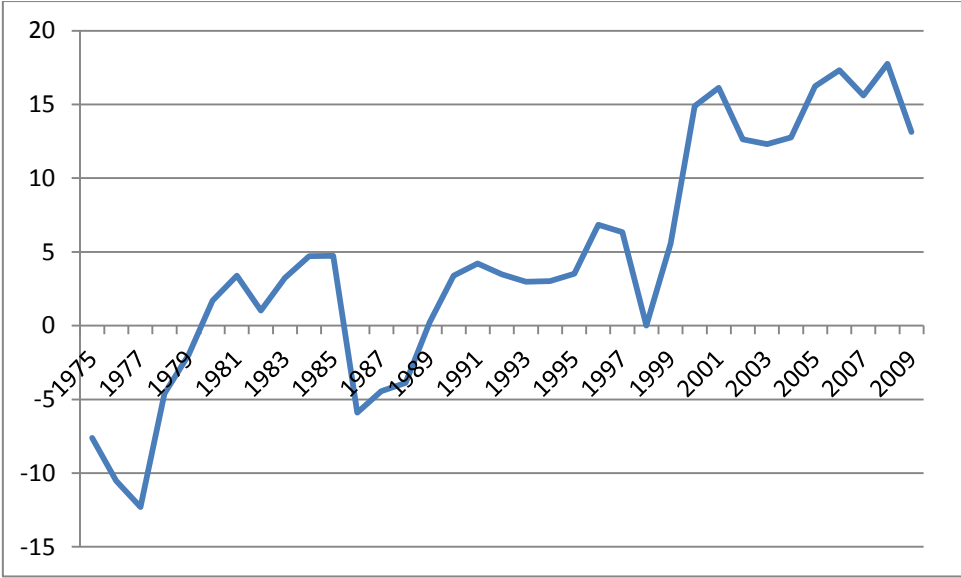
Source: (Madura and Fox 2007)

The example above shows that the cet. par. effect of a current account deficit is a downward pressure on the currency. However, it does not mean that as long as there is a current account deficit, there will be a subsequent depreciation of the nation's currency. As mentioned in part 2.3 there are several factors affecting the value of a currency simultaneously, and that these can offset the effects of a current account deficit. Holden points out that there probably needs to exist a significant current account deficit, for the value of a currency to depreciate. The USA for example, have had a current account deficit since the 1980's but have not really experienced a depreciation in the value of the dollar until lately. Holden argues that this is due to the deficit recently has crept over 5% of GDP (Holden 2007).

For Norway the situation is the other way around, with a current account surplus. This is mainly a result of the discovery of oil on the Norwegian continental shelf, and the revenues this and the petroleum industry in general has generated. Since the end of the 1990's, the

surplus have exceeded 10% of GDP (Index Mundi). The upward pressure this inflicts on the NOK is partially offset by The Government Pension Fund Global (a.k.a. the Petroleum Fund), and the investments the fund makes abroad.

Figure 2.6: Norwegian Current account surplus (% of GDP).



Source: (Index Mundi)

Balance of payments (mainly the current account) is unarguably an important driver of exchange rates, and illustrates the supply and demand for a nation’s currency. The trade balance is part of the current account, and the petroleum industry and its impact on the trade balance will be further illuminated in part 3.1.1.

3 DRIVERS OF THE NORWEGIAN KRONE

To be able to say something about the long run, we first need to say something about the short run. We will look at variables that have had an impact historically, variables that seem to influence exchange rates today and variables that can have an impact in the future. We will justify our choice of variables with previous empirical studies, and our own opinions based on acquired knowledge.

The first factor we will introduce is the petroleum industry. Here, we will describe its importance for the Norwegian economy, the effect of the oil price on the NOK, and how the revenues are managed through The Government Pension Fund Global (GPF). Thereafter, the interest rate differential between Norway and our trade partners will be discussed. These two factors are believed to be the main drivers for the NOK. Finally we introduce two factors that also influence the value of the NOK, but to a lesser extent than the first two; the stock markets and economic shocks.

3.1 The petroleum industry

The petroleum industry is divided into crude oil and natural gas. Crude oil includes NGL⁷ (natural gas liquids) and condensates. The production of oil and gas in 2010 depreciated by 4% compared to 2009. The total production equaled 230 million Sm³ o.e.⁸, with oil, gas NGL and condensates representing 104.4 mill Sm³, 106.4 mill Sm³, 15.4 mill Sm³ and 4.1 mill Sm³ respectively (SSB 2011).

3.1.1 Impact on the Norwegian economy

In 1969 the Norwegian oil adventure began with the discovery of oil at Ekofisk on the Norwegian continental shelf. Production of oil started in 1971. Norway has gone from being a

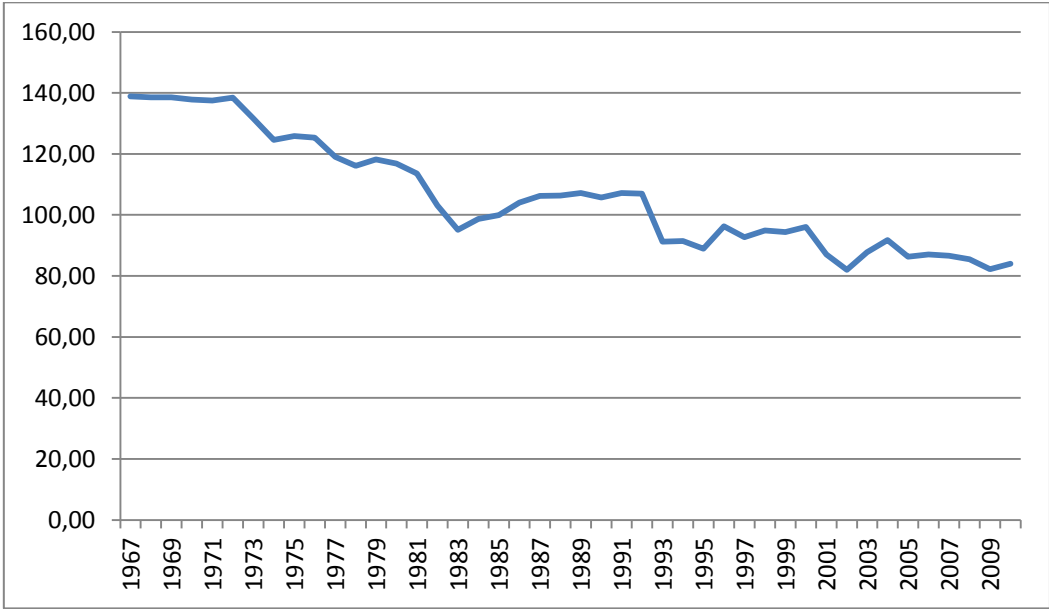
⁷ A generic term for different types of liquid petroleum

⁸ 1 Sm³: 0.84 tons of oil equivalents (o.e.). O.e. is an indication used to get oil, gas and condensates in the same unit of measurement.

relatively poor country, to currently being one of the wealthiest nations in the world with a high standard of living and a great welfare system. Currently the petroleum industry represents about 20% of the Norwegian GDP (Regjeringen 2010).

Sweden has always been a natural benchmark for Norway, and is currently also the largest national trade partner (Dagens Næringsliv 2011). Compared to Sweden, Norway had a significantly lower GDP per capita from 1900 until the 1990's. The trend was stationary at a level of 20% below Sweden from 1900, until the beginning of the 1970's. From this point on, there has been a continuous upward trend, and the current GDP per capita level is more than 40% above the Swedish' (Olsen 2008). The NOK/SEK relationship illustrated below clearly indicates an appreciation of the Norwegian krone from the beginning of the 1970's, and up until now (Norges Bank 2011).

Figure 3.1: The NOK/SEK exchange rate from 1967-2010.



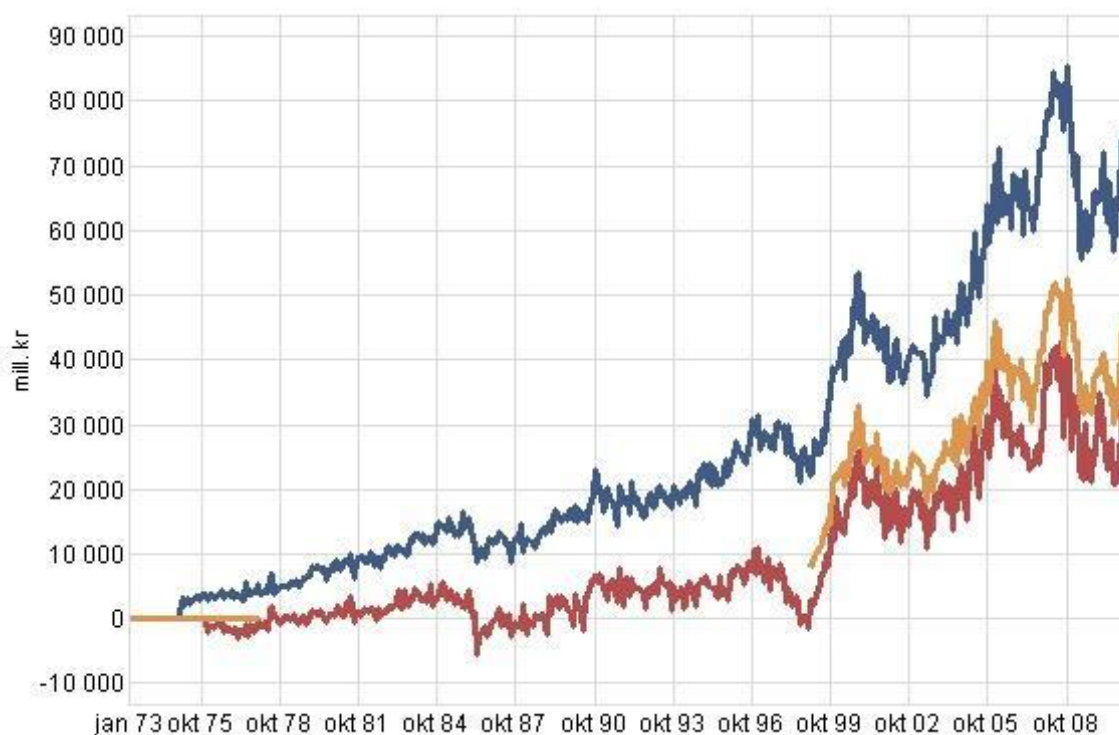
Source: (Norges Bank 2011)

Total imports for January 2011 was NOK 38.99 billion and exports totaled NOK 73.85, giving a trade surplus of NOK 34.87 billion. In this period oil exports and the petroleum industry as a whole represented 38.6% and 62.9%, respectively (SSB 2011).

Below is a graphical illustration of the Norwegian balance of trade. Without the revenues

generated from the petroleum industry, we can conclude that there would be a deficit on the trade balance. This clearly shows the importance of the petroleum industry on both the trade balance, and also on the Norwegian economy. In part 2.8 we argued that a current account surplus would leave an upward pressure on the nation's currency. For Norway, the trade balance, which is a part of the current account, leave an upward pressure on the value of the NOK.

Figure 3.2: Norwegian foreign trade.



Numbers are in million NOK. Source: (SSB 2011)

The blue line represents total exports, the orange line represents total exports of petroleum products⁹, and the red line represents the trade balance.

In part four we will assess the future development of the petroleum industry, and how it might affect the Norwegian economy in the long run.

⁹ Crude oil, natural gas and condensates

3.1.2 The Government Pension Fund Global (GPFG)

The oil price and the international financial markets both play a big role for the return on the Government Pension Fund Global (GPFG). The revenues from GPFG consist of the government's total income from petroleum activities, and the fund's return on investments (Regjeringen 2011). When the Norwegian government introduced the inflation target, a plan for how to use the petroleum revenues over the government budget, was drawn up. This is known as the *fiscal rule*. The fiscal rule was implemented to prevent swings in the petroleum sector from spreading to the mainland economy (Bergo 2004). Norges Bank established a spending rule that says that no more than 4% of the fund's return should over time be spent on the annual national budget (NBIM 2011). The idea behind the fund is to save money in good times, and spend money in bad times. Normally, an increase in the current account surplus will result in a higher demand for domestic currency. In Norway, foreign exchange revenues that accrue the Norwegian state due to a high oil price will be reinvested in foreign securities. This is done through the GPFG. Therefore, these revenues will not have a direct impact on the balance in the Norwegian foreign exchange market (Bergo 2004).

3.1.3 The oil price and the impact on the NOK

There is a general opinion among economists that the oil price influences exchange rates. DnB NOR analyst Maren Romstad (2008) found that primarily, the dollar has an influence on the oil price, and not the opposite. She argues that the correlation between the dollar and the oil price has recently increased. Previously, from 1980-2004, empirical studies show that a real increase in the oil price of 10 % resulted in a dollar increase of 9.4 %. This is not the case anymore. She suggests that the general opinion of the dollar being mentioned as the key reason for changes in the oil price, has had a strong effect (Romstad 2008).

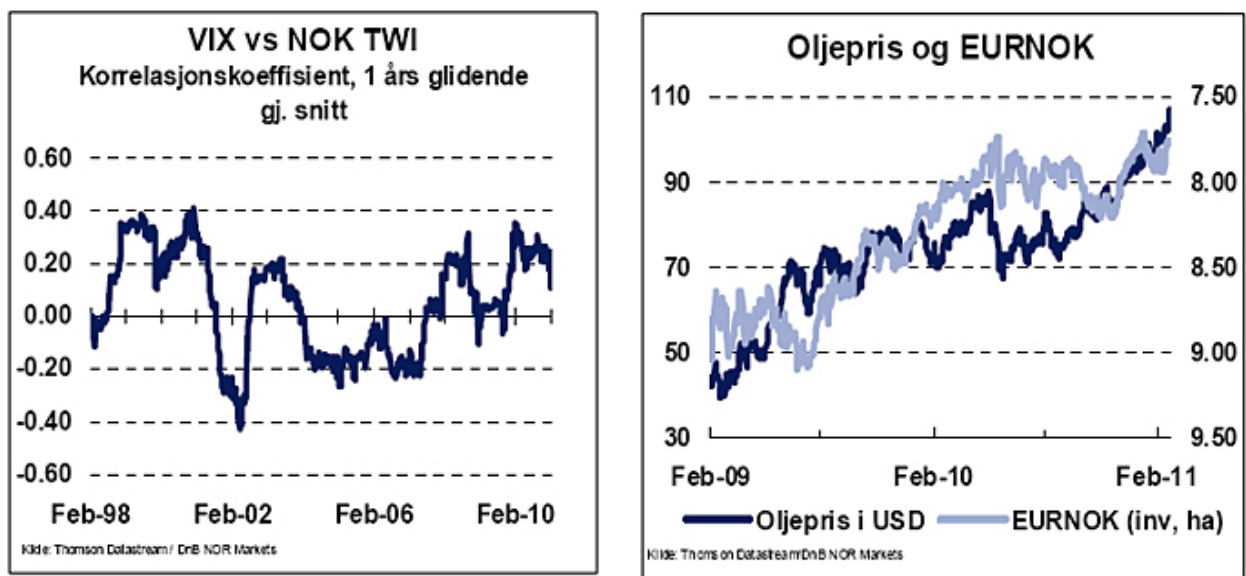
What about the relationship between the Norwegian krone and the oil price? Due to Norway's large oil sector, movements in the oil price must affect the Norwegian krone in some way. Since the oil is a necessary good, this means that an increased price will not necessarily result in a lower demand. An increased oil price will therefore represent higher revenues for Norway.

Haakon Solheim (2008) argues that a higher oil price will influence different channels for the Norwegian oil sector. A higher oil price will lead to increased oil revenues today and positive expectations for the future. Growth in revenues will primarily devolve the Norwegian government, and could lead to more investments. The effects of this will be higher wages for the households and a better economy in general due to an increased demand for labor in sectors connected to the petroleum industry (Solheim 2008).

Solheim (2008) also reflects on the channels that could have a negative effect due to higher oil prices. Energy demanding companies will react negatively in terms of production and this will reduce their revenues. An increase in energy prices will reduce household's real income and result in a decreased demand for goods and services. Norway's export will be influenced because the country's trade partners will scale down the activity level. If Norway's real exchange rate increases compared to other countries, this will make it harder for the traded sector. From economic theory we have learned that an appreciation of the NOK and a higher domestic activity level can cause increased inflation.

An interesting element is the correlation between the oil price and Norwegian krone, illustrated below.

Figure 3.3: VIX vs. NOK TWI-correlation and the oil price vs. NOK/EUR relationship.



Source: (DnB NOR 2011).

The graph above to the right, shows the correlation between the oil price and the NOK/EUR relationship. There are clear signs of a positive correlation over the last two years. The graph to the left illustrates the relationship between the VIX-index¹⁰ and the NOK. The VIX-index measures the fluctuations on the S&P 500 index and is a commonly used indicator to measure unrest in the financial markets. According to DnB NOR, previous studies have indicated that there is a positive correlation between financial unrest worldwide and the Norwegian krone. This means that financial unrest will lead to a decrease in the value of NOK. The political unrest¹¹ in North Africa and the Middle East, however, has led to an increase in the NOK, mainly because of a higher oil price (DnB NOR 2011).

What we have found in this part is that the petroleum industry plays an important role, both for the Norwegian economy and the Norwegian krone. We believe that in the future, the petroleum industry will remain as a major driver for the Norwegian krone. This will depend on the level of Norwegian petroleum reserves, and how the Norwegian government handles political issues regarding future oil revenues.

3.2 Interest rate differential

As the chapter about interest rate parity implies, the interest rate level between two countries can explain the exchange rate relationship. Changes in the Norwegian krone are often due to changes in interest rates. Increased interest rates normally make it more attractive to buy a claim and to reduce debt in NOK. This will lead to an appreciation of the krone. On the opposite, a reduced interest rate will reduce the demand for NOK and result in a depreciation against other currencies (Gjedrem 2001).

We have previously showed that the uncovered interest rate parity theory says that the expected change in the exchange rate between two countries is implemented in the interest rate differential. A currency is expected to appreciate (depreciate) by as much as its interest rate is lower (higher) than the interest rate in the other country (Pugel and Lindert 2000). This implies that based on interest rate differentials, one can have an expectation about the future

¹⁰ The premier benchmark for the U.S. Stock Market volatility, retrieved from Chicago Board Options Exchange (2009)

¹¹ The uproar in Egypt, Tunisia and Libya (2010-2011).

exchange rate between two currencies. If uncovered interest parity does not hold, an investor would speculate in these movements to gain profit from the difference in interest rates. This is often referred to as *carry trade*. Carry trade is an investment strategy used by investors or financial institutions in which they borrow money in a currency at a low interest rate (the funding currency). They invest the money in a currency with a high interest rate (the target currency). If the target currency does not depreciate against the funding currency, the investor/institution earns at least the interest differential (Gyntelberg and Remolona 2007). If uncovered interest parity holds, this investment strategy will not hold.

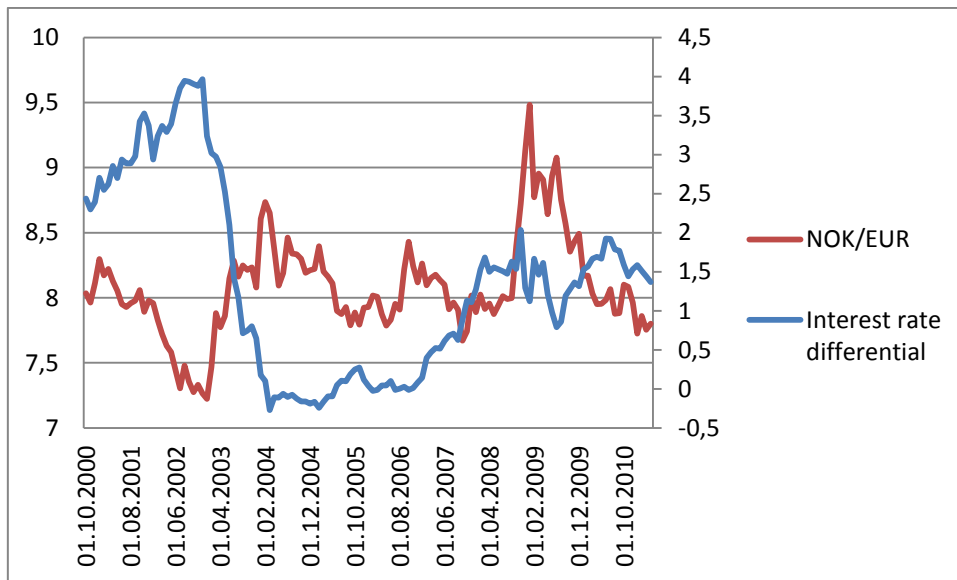
Chinn and Meredith (2005) found evidence that, from an unconditional forecasting perspective, interest rate differentials are of little use as predictors for the short term movements in exchange rates. For the long horizons, they argue that interest rate differentials only explain a small portion of the variance observed for exchange rates. However, UIP seems to do well compared to other structural models for the exchange rate (Chinn and Meredith 2005).

We have studied the development of the NOK/EUR relationship compared to the interest rate differential between NIBOR and EURIBOR¹². We observe that from 2001 to 2003, as the interest rate differential decreased, the NOK depreciated against the euro. From February 2004 to late 2007, the interest rate differential entered an upward going trend where the NOK appreciated against the euro. In the period from 2000 to late 2007, there is a negative correlation between the two currencies and the interest rate differential. From 2007/2008, it is harder to identify any clear patterns. The interest rate differential is more stable, and the NOK has appreciated strongly against the euro since the start of 2009. As mentioned in part 2.3, this can be explained by many factors, but we believe that the financial turmoil in Europe has had a big influence. Several nations (i.e. PIIGS-countries¹³) have high government debt and negative trade balances. The uncertainty surrounding the European Union and the euro as a common European currency has led to lower demand from investors and financial institutions. The debt situation in Europe will be assessed more thoroughly in part 4.2.

¹² 3-month interbank offered rates

¹³ Portugal, Ireland, Italy, Greece and Spain

Figure 3.4: The NOK/EUR relationship versus the interest rate differential.



Source: (Thomson Reuters 2011)

Even though the theory of uncovered interest rate parity does not always seem to hold, interest rates are known to be a factor that affects exchange rates. If we take our fifty to eighty year perspective into the equation, we will not be able to predict exchange rates based on interest rates alone. The market for interest rates is volatile, and changes happen very quickly. Unpredictable events may occur. This could force a national government to change the interest rate in another way than first expected.

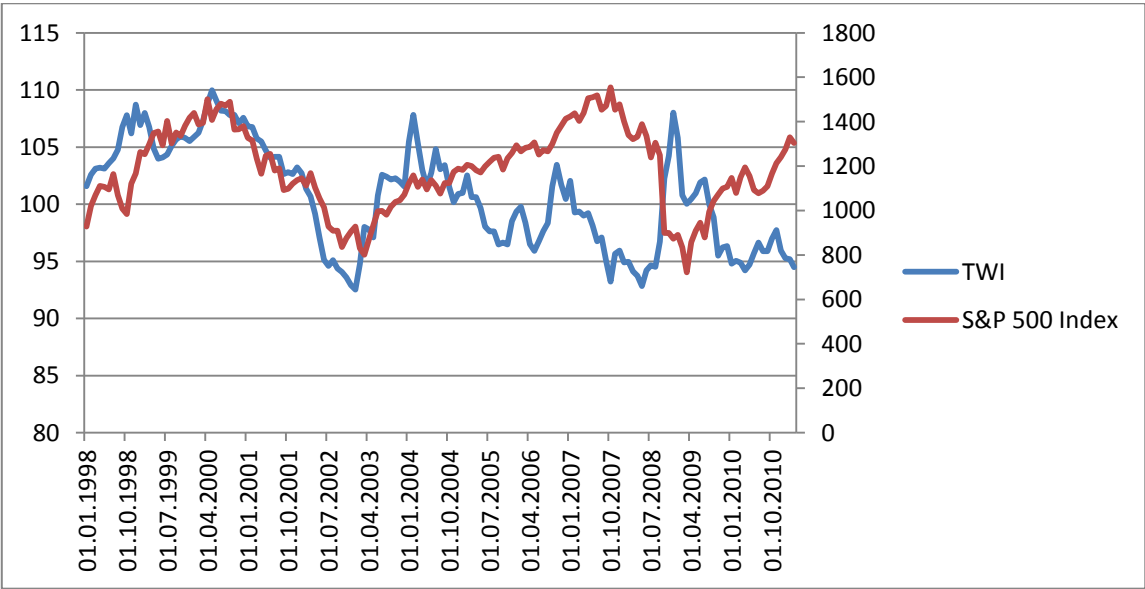
Norway is currently experiencing economic growth, with low unemployment and increasing house prices. This should imply a rising interest rate. A challenge for the Norwegian government will be how to balance the interest rate level so that the economy does not overheat, without hampering the conditions for the traded sector.

Based on the explanations above, we conclude that interest rate differentials are inadequate when predicting exchange rates in a 50-80 years time horizon.

3.3 The stock market and the Norwegian krone

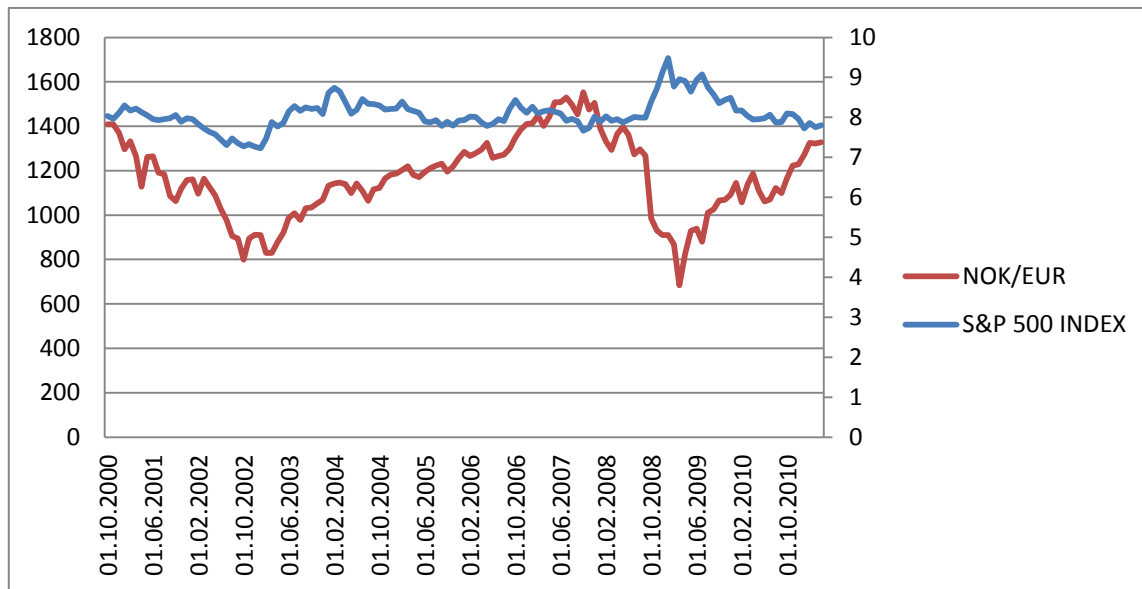
In addition to the petroleum industry and interest rate differentials, stock markets are considered to have an impact on exchange rates. From 2000 to 2003, the Norwegian krone experienced a strong appreciation. Naug (2003) found that the drivers behind the NOK-appreciation were the oil price, interest rate differentials and the stock market. In his study he examined the relationship between the NOK, represented by the Trade Weighted Index (TWI), and the S&P 500 index. He found that they were highly correlated from January 1999 until January 2003. The relationship is clearly visible in the graph below, especially in the time period pointed out (Naug 2003). The tendencies are the same for the NOK/EUR exchange rate versus the S&P 500 Index, but from 2007 the relationship seems to change from a positive to a negative correlation. The TWI versus S&P 500 seems to experience a negative correlation from 2005. Even though the picture at times can be a bit unclear, there is no doubt that stock markets are to some degree correlated with exchange rates.

Figure 3.5: The TWI exchange rate vs. the S&P 500 Index.



(Thomson Reuters 2011)

Figure 3.6: The NOK/EUR exchange rate vs. the S&P 500 Index.



(Thomson Reuters 2011)

How come there is, at times, such a strong relationship between exchange rates and stock markets? Investors always pursue investments with the highest return at a given level of risk appetite. If expected future returns seem uncertain, investors will seek other investment opportunities. This is what happened when stock markets dropped in the period from 2000 to 2002. Investors shifted their positions from stocks to interest-bearing securities due to the lack of faith in the stock market return. In this time period, the interest rate differential between Norway and the Eurozone was positive, up to 4% at times, as we can see in figure 3.4 (DnB 2011). The high interest rate differential combined with a low exchange rate volatility, made the Norwegian krone more attractive to the investors (Naug 2003).

Can the stock markets be used as a long term exchange rate predictor? Stock markets are highly volatile. They react to unexpected events like the financial crisis in 2008-2009. The Norwegian stock exchange (Oslo Børs) for example, dropped from about 520 points to about 190 points in less than seven months (Oslo Børs 2011). This illustrates the sensitivity to unexpected events and also how unpredictable stock markets can be. Even though exchange rates are correlated with stock markets to some extent, this correlation seems to be inconsistent. This is especially visible in figure 3.5, where it in 2007 shifts from positive to negative. This inconsistency and the volatility of the stock markets make it difficult to determine future exchange rates. Stock markets are in the long run driven by the general

conditions of the economy. It is therefore more reasonable to consider what drives stock markets rather than the stock markets themselves. For a time period of fifty to eighty years we conclude that stock markets are unsuitable as a predictor for the NOK/EUR relationship.

3.4 Economic shocks

An economic shock is an event that can cause a drastic change in an economy. A shock is both unusual and unpredictable. It is often related to a change in an exogenous variable. This is a variable that can't be explained by economics. An example is a natural disaster, such as an earthquake. A large earthquake can lead to financial unrest among investors and can for example result in falling stock prices. This is often a result of a negative shift in the investor's demand. The demand is an economic factor and represents the endogenous variable in this example. Another example is a temporarily stop in the oil production in a country such as Libya, which could lead to higher prices and concerns about the general oil supply. This is what we have seen in the Northern part of Africa recently, though this is triggered by political unrest rather than a natural disaster. This was also observed in the Middle East from February 2002 to 2003, where investors witnessed a strong appreciation of the NOK. This was due to investors considering the NOK as a "safe haven" where they could hedge against potentially rapid rising oil prices (DnB NOR 2011).

Disasters that occur over a small area in a large country have little effect on the long run growth, while the same disaster could actually decimate the economy of a small country that is more vulnerable (Popp 2006). Natural disasters play an important role in macroeconomic activity, but not necessarily like people seem to expect. Skidmore and Toya (2002) found a positive correlation between climatic disasters and economic growth, human capital investments and growth in factor productivity. A negative correlation was found between geologic disasters and economic growth (Skidmore and Toya 2002).

Though such economic shocks are unpredictable, we must take into account that these shocks can happen. As we have shown earlier, macroeconomic changes influence exchange rates. A certain shock may not have a big impact on a country's economy for a large period, but in the short run it could have an effect on the supply and demand for a currency. For the purpose of long term exchange rate prediction, we conclude that economic shocks are not inadequate.

4 GLOBAL MACROECONOMIC FACTORS

In our prior discussions we have concluded that what is generally considered to be drivers of the Norwegian krone are for the most part inadequate for the purpose of our thesis. They are too volatile and unpredictable in the long run, and the effects tend to be short term. We believe that the next logical step for us to reach our objective will be to consider the problem from a more superior perspective. If we can form a picture of how the Norwegian, the European (Eurozone) and the world economy will progress in the future, we might be able to make projections on a possible trend for the NOK/EUR exchange rate.

A diminishing Norwegian petroleum industry, demographic changes, a slow recovering European economy, emerging markets challenging the established (advanced) nations and a halting U.S. economy are factors that directly or indirectly can affect the future EUR/NOK-relationship.

We have decided to divide this chapter into three parts; the Norwegian economy, the Eurozone and the world economy. Currently there exists, to our knowledge, no economic reports or projections for such a long time horizon as up to 80 years. The choices we have made in this part are based on macroeconomic theory and our own opinions.

4.1 The Norwegian economy

Norway has a small, open economy which is dependent on international trade. Import and export constitute around 50 percent of Norway's gross domestic product (Den norske EU-delegasjonen 2011). As we have shown in previous chapters, the petroleum industry and the oil are important resources for Norway, but these will eventually come to an end. In addition to the scaling down of the petroleum industry, Cappelen, Eika and Prestmo (2010) argue that the demographic development, the growth of the Government Pension Fund Global and the world economy are the factors that will affect the Norwegian economy in the future.

In this part we will present what we believe to be the most important factors concerning the future Norwegian economy. How will Norway cope after the oil era in terms of economic

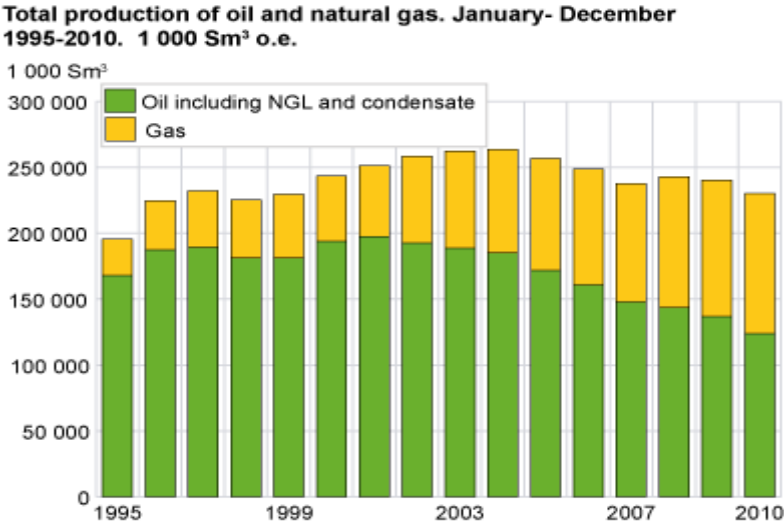
growth? Will this affect employees associated with the oil industry and the Norwegian labor market in general? How will the Norwegian government deal with the ageing-problem?

4.1.2 The Norwegian oil reserves

In part four we illustrated the effects that the petroleum industry has had on the Norwegian economy. An important question regarding Norwegian economy, and also the value of the Norwegian krone, is how much oil and gas is left on the continental shelf?

The peak of the Norwegian oil production was probably in year 2000, where the production of crude oil was 181 million Sm^3 . Production of gas has on the other hand doubled since the millennium, and is currently representing about 46% of the total production of petroleum products (SSB 2011).

Figure 4.1: Petroleum production from 1995-2010.



Source: (SSB 2011)

In a report made by the Norwegian Petroleum Directorate (NPD), the total recoverable petroleum reserves are estimated to be 12.8 billion (Sm^3) o.e., whereas 5.5 billion Sm^3 o.e. have been sold and delivered. The estimates of undiscovered resources are expected to be 7.3 billion Sm^3 o.e., with a range of uncertainty between 4.8 and 10.6 billion Sm^3 o.e. The estimates are made on the basis of technical and geological assessment (Oljedirektoratet

2011). In 2010, production started from four new fields. In addition, 16 new discoveries were made. This can result in a resource growth of 78 million Sm³ o.e. of oil and 38 billion Sm³ of gas. The problem is that many of the discoveries have not been fully evaluated, meaning that the estimates are uncertain.

A debate whether to start an environmental impact assessment in Lofoten, Vesterålen and Senja has escalated over the last few years. Political parties and oil companies are desperate to find out how much oil there is in this area. They want to start drilling as soon as possible, but the Norwegian government has decided to wait at least until the next Parliament election (Eriksrud 2011). In 2010, the Norwegian Petroleum Directorate estimated that 202 Sm³ million o.e. could be found in the evaluated area. NPD's analysis indicates a 95 percent probability of finding at least 76 million Sm³ o.e., and a five percent probability of locating more than 371 million Sm³ o.e. (Oljedirektoratet 2010).

Norway's oil reserves will have an effect on the foreign international trade for years to come. The country was the seventh largest exporter of oil (2010) and the second largest exporter of gas (2009) in the world (Finansdepartementet 2011). A decrease of these resources will have a negative impact on the trade balance, and it is therefore important to produce estimates on how long the petroleum resources will last.

Höök and Aleklett state the following about the outlook of the Norwegian petroleum sector:

“Norway will barely be an oil exporter by 2030, with only a few hundred barrels of oil available for export in the best case” (Höök and Aleklett 2008).

If Norway does not find new, large oil fields, their trade partners will have to switch their demand towards other oil exporting nations. This can result in a deficit on the trade balance in the future if Norway cannot come up with a perfect substitute. Höök and Aleklett (2008) base their studies on official data from NPD and they have analyzed every oil field separately in terms of depletion rate, decline rate and cumulative production.

Their analysis was met by skepticism from director Johannes Kjøde in NPD. His arguments were that the Swedish researchers based their studies on a static picture rather than focusing on the dynamics in the market. Whether Kjøde has a good point or not is hard to say. The reality however, is that Norway eventually will lose their position as one of the leading oil nations in the world. As a consequence, Norway could keep the oil in the ground and have a

more moderate oil production policy. This can ensure the future wealth for the Norwegian people (Höök and Aleklett 2008).

4.1.3 The scaling down of the petroleum industry

Recently there have been several debates about the consequences of a reduced petroleum industry for Norway. The oil (petroleum) revenues have been a blessing for the Norwegian government since the discovery of Ekofisk in 1969. As the reserves eventually will come to an end, economists have different opinions about what this will mean for Norway.

The research published for SSB by Cappelen et. al. includes estimates up to 2030. These estimates are based on forecasts for petroleum production made by the Norwegian petroleum directorate (NPD). The writers assume that today's current policy rules, regarding the petroleum industry, will continue in the future.

Below is an overview of the prognosis done by the Norwegian Petroleum Directorate (NPD) in 2009:

Table 4.1: SSB prognosis.

	2010	2011-2015	2016-2020	2021-2025	2026-2030
Investments	114,10	118,00	109,70	98,70	81,80
Intermediate consumption	109,10	106,10	107,10	102,50	83,50
Labor (in thousand)	42,90	43,70	41,30	35,40	28,00
Production of oil and gas	459,50	446,70	452,40	405,10	306,80

Numbers are in billion 2007-NOK. Source: (Cappelen, Eika et al. 2010).

From the table we observe that the general activity in the petroleum activity is expected to decrease for the next 20 years. SSB's researchers argue that the reduced activity not necessarily will create macroeconomic challenges for the Norwegian economy. This is mainly due to the fiscal rule implemented by the Norwegian government, but also because of changes in the demography. A reduction of the petroleum industry is likely lead to a labor-supply surplus. At the same time, the ageing of the population will decrease the supply of labor. The downscaling of the petroleum industry and the ageing population will therefore have an offsetting effect on the labor market. It will consequently be hard to maintain the high level of

production that the country has had since the early 1990's. This will subdue the potential effects a shock can lead to, and reduce the pressure on the Norwegian economy (Cappelen, Eika et al. 2010).

Another interesting fact pointed out by SSB, is that Norway does not use the revenues generated from the petroleum industry. This means that Norway is currently not dependent on these revenues. Those making a living from the oil production are primarily the ones employed by the oil companies, and they work as the rest of the Norwegian population.

The petroleum production gives Norway capital income from accumulated economic rent, and leads to a higher national income. SSB has found that this income only equals two years of normal economic growth. The bureau's conclusion is therefore that the problem "how to survive without the oil", is more of a misunderstanding than a concrete problem. To maintain the country's wealth in the future, it is all about being able to exploit available labor (Cappelen, Eika et al. 2010).

SSB's report, made to help politicians plan for the future, has led to a constructive debate among economists. Knut Anton Mork and his colleagues from Handelsbanken recently published a macroeconomic report based on forecasts. In this report they argue that SSB simplify the potential challenges after the oil era. Mork et. al. believe that the high earnings generated by the mainland industries is not only due to high productivity. They believe that a "natural local monopoly enables mainland industries to appropriate part of the resource rent, which one day will end" (Mork, Bache et al. 2011). They argue that non-oil industries benefit from the traded petroleum sector, both directly and indirectly. Examples drawn are the financial industry, restaurants and hotels. Handelsbanken conclude that the Norwegian government has neglected important investments in infrastructure, and spent too much on consumption and transfers. The bank claims that once the oil and gas industry winds down, the level of government spending will be reduced. The overall prediction is a potentially painful transition for Norway.

Professor Hilde Bjørnland from Handelshøgskolen BI is also critical to SSB's report. She claims that reduced oil revenues will have indirect effects on the Norwegian supply industry and the Oslo stock exchange. National oil revenues create a conviction that good times lie ahead and this increase firms risk tolerance and make them invest more money. Bjørnland argues that Norway, together with Canada and Australia, has done well in terms of economic

growth since the financial crisis. The reason for this is that all these economies are based on commodities (natural resources) (Bjørnland 2011).

4.1.4 Ageing of the population and challenges in the labor market

Many countries in Europe will in the future experience a rise in the proportion of elderly in the population (Østby 2004). In Norway, the group of people over 67 years is estimated to double by 2060. This group will increase from 0.6 million to 1.5 million people. The population of people over 80 years of age, is expected to get tripled (NHO 2010).

The massive increase in elderly people represents a big challenge for the Norwegian government. This will result in increased government expenditures, which are expected to exceed the overall growth in the economy. The demand for healthcare will be higher as the numbers of pensioners grow faster (Gjedrem 2009). An interesting question to this major concern is how the Norwegian politicians will deal with the ageing problem. There have been discussions about raising the tax level, but there might be some complications in terms of implementing these changes in a discrete way.

Næringslivets Hovedorganisasjon (NHO) made an analysis for the time period 2030-2050, where the purpose was to find out how much money it will cost for Norway to maintain healthcare, senior care and pensions at the current level. The analysis concludes that this will constitute about 13.5 % of Norway's GDP, or 261 billion Norwegian kroner. This will represent a yearly tax raise of 32.400 NOK for every person who pays tax to the Norwegian government (NTB 2010).

As described above, there will be a strong labor demand in the Norwegian public sector, primarily within health. The challenges that await Norway in the future can have an impact on the general economy, and this can affect the exchange rate between the Norwegian krone and the euro. A downward trend in the economic activity level can result in a lower GDP growth. If the real GDP in Norway is lower relative to the real GDP in the Eurozone, macroeconomic theory says that the NOK would depreciate against the euro in the long run (Pugel and Lindert 2000). The pensioners will represent a large share of the total Norwegian population in the future. This implies a reduced labor market, hence lower production and a decrease in the GDP growth.

4.1.5 The Eurozone as a trade partner

The European Union is Norway's most important trade partner (Regjeringen 2011). Out of Norway's total exports and imports, the European Union represents around 80% and 66.8% respectively. Trade between countries also illustrates the supply and demand-relationship of the respective currencies, cf. part 2.8. This implies that the EU is important for the future demand of the NOK.

Previously we have established that the Norwegian exports related to the petroleum industry are expected to decline heavily from around 2020. According to statistics retrieved from the European Commission, the petroleum industry constitutes 56.8 % of the total trade from Norway to the European Union. As the exports from the petroleum industry are expected to diminish, the EU must switch its demand for oil towards other markets. The demand for NOK will decrease, and this could lead to a depreciation of the currency.

The numbers provided by the European Commission includes all of the 27 member countries in the European Union, and not just the Eurozone. Some countries, including Great Britain and Sweden, have not adopted the euro, but they are both important trade partners for Norway. Our focus is on the NOK/EUR relationship, meaning that countries outside the Eurozone should not be evaluated. Currently the Eurozone represents more than 2/3 of the total output from the European Union (European Commission 2009).

Table 4.2: Total Norwegian exports and imports.

	The major import partners			The major export partners			The major trade partners		
1	EU27	32,544.7	66.8%	EU27	69,635.3	80.6%	EU27	102,180.0	75.6%
2	China	3,829.8	7.9%	United States	4,170.0	4.8%	United States	7,207.6	5.3%
3	United States	3,037.6	6.2%	Canada	1,847.1	2.1%	China	5,576.3	4.1%
4	Japan	1,219.8	2.5%	China	1,476.5	2.0%	Canada	2,936.1	2.2%
5	Canada	1,089.0	2.2%	South Korea	1,670.8	1.9%	South Korea	2,609.2	1.9%
6	South Korea	938.5	1.9%	Japan	897.4	1.0%	Japan	2,117.3	1.6%
7	Russia	793.1	1.6%	Singapore	812.1	0.9%	Russia	1,446.8	1.1%
8	Brazil	605.8	1.2%	Russia	653.7	0.8%	Switzerland	987.3	0.7%
9	Switzerland	552.5	1.1%	Turkey	493.0	0.6%	Singapore	975.7	0.7%
10	Turkey	381.3	0.8%	Switzerland	434.8	0.5%	Brazil	931.2	0.7%

Source: (European Commission 2011)

4.2 The Eurozone

In the following we will assess the Eurozone's economic prospects. We will consider the current debt situation that has taken its hold on the European economy. Like we argued in part 4.1.5, the future trading conditions for the Eurozone is likely to have an impact on the value of the euro.

The EU is currently the largest economy in the world with its 27 member nations. Estimates from 2010, place the EU economy marginally in front of the American with a GDP at PPP of \$14,900 million vs. \$14,720 million (CIA 2011). 2009-estimates from the European Commission show that the EU represents 16.58% of world trade. USA and China follows on second and third place with 13.69% and 11.46% respectively.

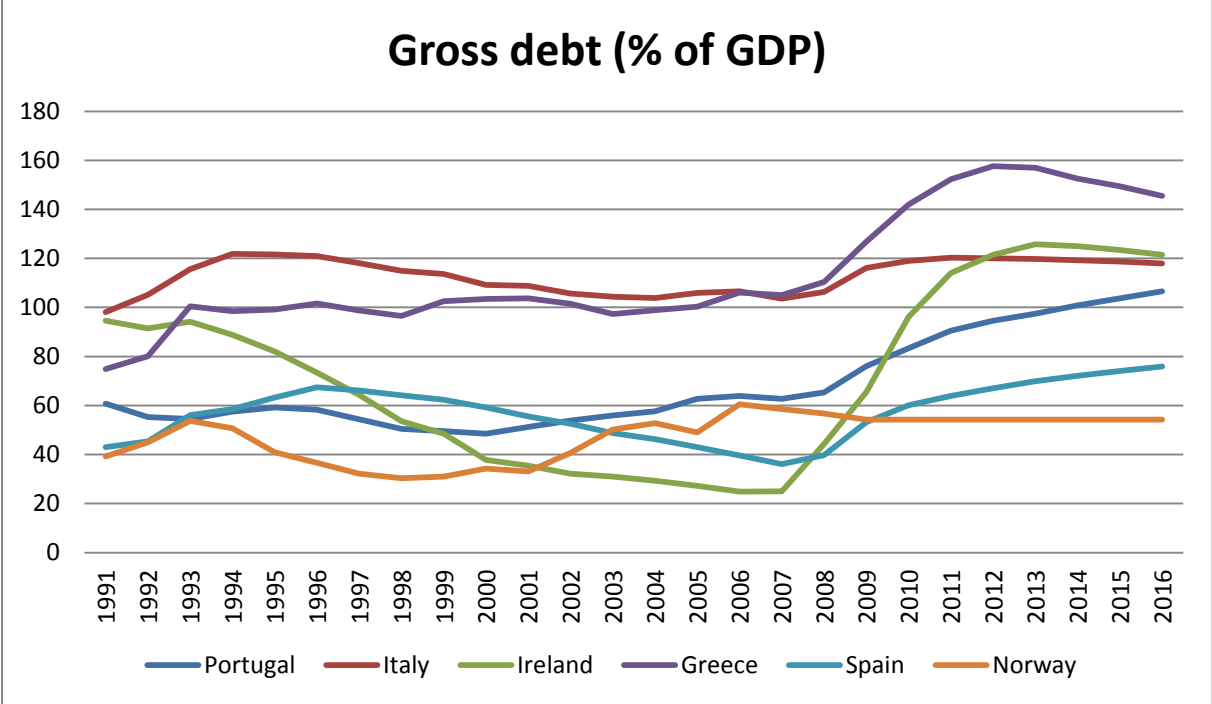
In the majority of statistics available, the Eurozone is generally not separated from the European Union. In 2006 the Eurozone represented 14.6% of world GDP (at PPP), and the whole EU represented 21%. In the following discussions we will use data on the euro area where it's available.

4.2.1 The debt crisis in the European Union

When the financial crisis hit the world in 2008, it revealed a fragile financial system in several of the member countries of the European Union. This was mainly a consequence of excessive lending for several years before the bubble finally burst (Handelsbanken 2010). Due to high debt, both Ireland and Greece were in 2010 forced to accept financial aid from the EU and IMF (DnB 2011). Greece currently has a gross debt of about 150% of GDP. Italy and Ireland follows with 120% and 114% respectively (Thomson Reuters 2011). For 2011 the PIIGS-countries alone, have an estimated financial need of EUR 666 billion (DnB 2011). The graph below shows the development and projection of future gross debt for the PIIGS-countries and Norway, until 2016. We can see that the gross debt has increased heavily for the PIIGS-countries since the financial crisis struck. For Norway the situation is considerably better, with a current gross debt level of about 55% of GDP, where it will remain stable until at least

2016 (Thomson Reuters 2011). The graph shows that the expectations regarding the improvement of the PIIGS-countries' debt level, are rather low.

Figure 4.2: Gross debt PIIGS and Norway.



Source: (Thomson Reuters 2011)

Empirical studies show that such high levels of debt are not sustainable. As gross national debt reaches 90% of GDP, it tends to inhibit growth, partially due to high government bond rates (DnB 2011). As the risk of collapse has risen in several nations, interest rates (yields) on government bonds have increased rapidly due to the high risk premium. Government bonds with a ten-year maturity, issued by e.g. Greece and Portugal, were in April 2011 yielding 15.66% and 9.64% respectively (Trading Economics 2011). The high government bond rates and the costs they represent for a nation will be at the expense of private investments and productivity growth. As the difference between government borrowing rates and economic growth rates increases, the challenge of stabilizing debt gets even harder. For Greece and Ireland, with a gross debt around 150 % and 120 % of GDP respectively, costs related to debt will therefore hamper the economic growth for many years to come.

4.2.2 Trade in the EU and the Eurozone

Cross country trade is an important driver for the exchange rates. As for the NOK/EUR relationship, the future trade flow in the Eurozone will have a direct and an indirect impact on the exchange rate. If the EU experiences low economic growth, this can have a negative effect on the demand for Norwegian goods. The demand for the Norwegian krone will consequently be reduced. Indirectly, the NOK/EUR exchange rate could be affected if the euro were to depreciate on a general basis. This depreciation could come as a result of decreased demand for euro-goods and services, cf. part 2.8. A weaker euro would make Norwegian goods less attractive, due to an unfavorable exchange rate.

Currently the biggest EU trade partner is the BRIC¹⁴ - nations. Out of the total imports and exports, the BRIC-nations count for 33.7% and 19.7% respectively (European Commission 2011). IMF points out that the emerging markets have recovered faster and are experiencing a higher GDP growth, than the so-called advanced economies (IMF 2011). The BRICS nations will by 2015, according to Dagens Næringsliv represent one third of the world economy (Lund 2011).

In 2010, BRICS experienced an economic growth of 7.3%, vs. 3% for the advanced economies. As these nation's economies continue to prosper, the standard of living will increase. The need for improvement in infrastructure will increase, as will demand for luxury goods. Consequently, increase in the demand for manufactured goods, machinery, transport equipment and oil will follow.

The main areas of export in the Eurozone and the EU are manufactured goods. E.g. SITC¹⁵ 7 *machinery and transport equipment* represents 41.9% of total exports. The BRICS demand for Eurozone and EU goods are therefore likely to increase in the coming years. As the

¹⁴ BRIC have extended to BRICS, as South Africa joined in 2011. Throughout the paper, BRIC and BRICS will be used interchangeably. This is due to South Africa becoming a member in 2011. Therefore, in the majority of data provided South Africa is not included. BBC (2011). "Will Brics strengthen South Africa's economic foundations." Retrieved 04.05, 2011, from <http://www.bbc.co.uk/news/world-africa-12113830>.

¹⁵ "The Standard International Trade classification of the UN, allows a comparison of external trade statistics to be made on a worldwide basis" European Commission (2010). "International trade in goods." Retrieved 22.04, 2011, from http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/International_trade_in_goods.

demand for euro goods increase this will (cet. par.) leave an upward pressure on the value of the euro.

Table 4.3: European exports to the world.

European Union, exports to the world		Value	Share of
SITC codes	SITC sections	millions of €	total (%)
SITC T	TOTAL	1 348 278	100,0%
SITC 7	Machinery and transport equipment	564 427	41,9%
SITC 6	Manufactured goods classified chiefly by material	166 827	12,4%
SITC 5	Chemicals and related prod, n.e.s.	140 563	10,4%
SITC 8	Miscellaneous manufactured articles	136 325	10,1%
SITC 3	Mineral fuels, lubricants and related materials	75 164	5,6%
SITC 0	Food and live animals	52 474	3,9%
SITC 9	Commodities and transactions n.c.e.	39 317	2,9%
SITC 2	Crude materials, inedible, except fuels	34 179	2,5%
SITC 1	Beverages and tobacco	17 566	1,3%
SITC 4	Animal and vegetable oils, fats and waxes	3 020	0,2%

Source: (European Commission 2011)

4.2.3 Projections on future economic growth

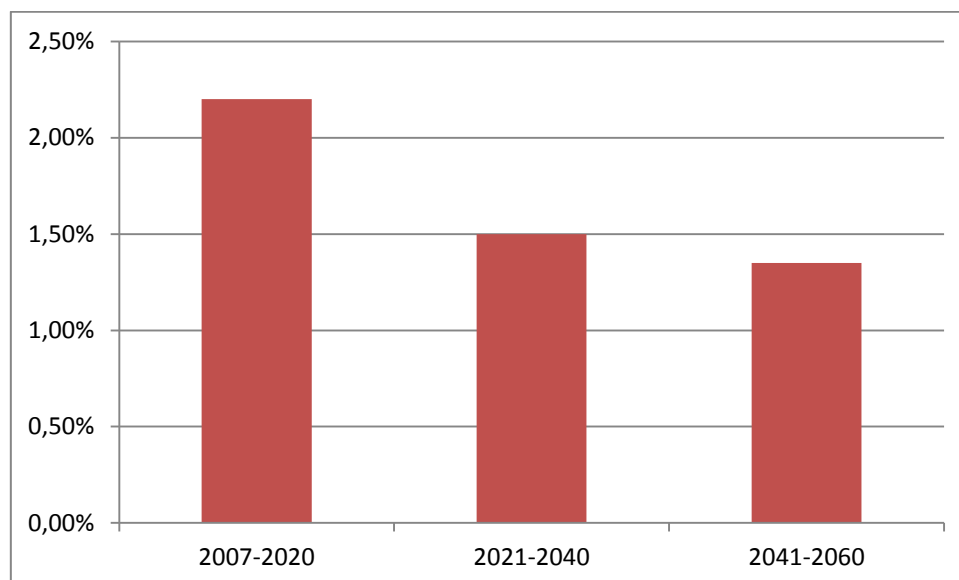
The debt situation will be a challenge for the EU and the Eurozone in the coming years. A lot of resources will be allocated to re-establish economic and financial stability, hence the economic growth is assumed to be low in the coming years. “*A gradual and uneven recovery is under way in Europe*”, is one of the headlines in the IMF *World Economic Outlook 2011*-report. Advanced Europe¹⁶ is recovering slower than Emerging Europe¹⁷. Real GDP¹⁸ for advanced Europe is expected to grow by 1.75% in 2011 and by 2% in 2012. For emerging European economies, the projections are 3.75% in 2011 and 4% in 2012. For Norway, the GDP projections are 2.9% and 2.5% for 2011 and 2012 respectively. The Eurozone is expected to have a real GDP growth in 2011 and 2012 of 1.6% and 1.8% respectively (IMF 2011). Below are projections on GDP growth for the Eurozone from 2007-2060, based on estimates by the European Commission.

¹⁶ E.g. Germany, France Italy, Belgium, Austria, Greece, Portugal (IMF 2011).

¹⁷ E.g. Turkey, Poland, Romania, Serbia, Croatia Latvia (IMF 2011)

¹⁸ GDP, adjusted for inflation.

Figure 4.3: Projected GDP growth for the Eurozone.



Source: (European Commission 2009)

Like Norway, the EU will also experience changes in the demography. According to a report made by the European Commission, the population over 65 is estimated to increase approximately by 75% and 125% by 2060, for the Eurozone and Norway respectively. In the report Norway is assumed to experience a growth in costs related to the ageing of the population¹⁹ of about 9% compared to about 4% for the Eurozone (European Commission 2009). These costs will represent a major challenge for the Eurozone economy, and will therefore be an important factor in our prediction of the long term NOK/EUR relationship.

Will Greece, Ireland and Portugal be able to repay their loans from ECB and IMF, or is a restructuring of their debt inevitable? If so, how will this impact the Eurozone economy? Will Spain or Italy follow? There are a lot of uncertainties surrounding the EU and the Eurozone, which reflect the difficulties regarding long term projections. From the IMF discussion forum, a member describes the situation in the following way:

¹⁹ Pensions, health care, long-term care, unemployment benefits and education.

“I doubt long-term projections can be executed with even a minimum degree of accuracy right now. There is too much uncertainty in the marketplace that does²⁰ deep, all the way to the consumer level that then ripples upward to affect the financial sector and markets and ultimately government balances.” (IMF 2010).

For the purpose of our thesis we will have to assume that the EU and the Eurozone makes it out of the crisis, and also that the euro as a currency survives. IMF argues that on the positive side of the current financial turmoil, the EU and the Eurozone will hopefully emerge with stronger policy institutions and have made big steps toward its goal of integration and convergence amongst the member countries (IMF 2009).

4.3 The world economy

The world has become a smaller place over the last decades. The interactions between countries and continents are getting larger by the day, and the technological development has made communication and international trade easier. “Norway is effectively less integrated in the global economy than many of its peers. Norway’s economic performance is strong but reflects the role of natural resource wealth rather than the attractiveness of the country as a business location” (Ketels 2011). If we assume that the Norwegian petroleum industry eventually will come to an end, Norway must integrate more in the international society. Norway has a small, peripheral role in the world economy, and global events can have a big influence on the country in several ways. On the opposite, events that occur within the Norwegian economy would not have a big effect on the world economy.

For the Eurozone, the situation is different. Changes that arise in other parts of the world will influence the Eurozone in a more substantial way than in Norway. The Eurozone has a closer connection to USA and the emerging markets in terms of trade and other political measures.

In this part we will focus on United States’ position in the world, and how emerging markets are getting more involved in international trade and investments.

²⁰ Presumably a typo for; *goes*

4.3.1 The American economy

The European Union may be the largest economy in the world based on the Gross Domestic Product (GDP), but USA is still the richest country in the world (CIA 2011). The American economy has suffered since the financial crisis, but there are signs of improvement. Today's economic situation is complex. Budget deficits, increasing debt, a negative trade balance and heavy military commitments are some of the challenges that need to be dealt with. USA is self-sufficient in commodities, with the exception of oil. In 2009, the sum of imports and exports constituted 25 percent of the country's GDP. The country is by far the world's largest importer of goods (Utenriksdepartementet 2011).

The activities of The Federal Reserve and the world economy influence each other. When deciding on monetary policies aimed to reach certain economic goals, The Federal Reserve considers the record of US international transactions, changes in foreign exchange rates, and other international economic developments. Policies made by the American central bank are influenced by international developments, and vice versa. To maintain stability in the international markets, the Federal Reserve can make international transactions with the purpose of influencing the value of the dollar in relation to foreign currencies. During some episodes of downward pressure on the US dollar, the Federal Reserve has purchased dollars (sold foreign currency), reducing the selling pressure on the dollar. Likewise, the Central bank has sold US dollars during episodes of upward pressure on the currency (The Federal Reserve 2011).

American domestic reports from markets such as labor, real estate or interest rates, have an impact on the world's stock markets, and to some extent exchange rates. If the reports do not match the investors' expectations, the international financial markets will react in a negative manner. If the reports exceed the expectations, the financial markets will react in a positive manner, resulting in a rise in the stock markets in the USA and also the rest of the world. A weak American economy could also lead to lower demand for imports of goods and commodities, which can affect USA's most important trade partners.

USA has a close, economic relation to Norway. As mentioned, Norway supplies the world market with oil, and USA is a leading actor in this market. In recent years, Norway has

become an investor in the US markets through The Government Pension Fund Global. The GPFG has invested around one third of the value in the USA (Utenriksdepartementet 2011).

At the end of March 2011, USA had an unemployment rate of 8.8 percent (BLS 2011)²¹. As mentioned, USA is self-sufficient and its economy is dependent on the consumers. If the consumers do not work, the production will stop and the overall consumption will be reduced. With such a high unemployment rate, it will be difficult for the American economy to maintain high economic growth in the coming years.

The unemployment rate will remain high in the next years. Private employment will rise much faster than government employment (Handelsbanken 2010). In October 2010, the American central bank started purchasing Treasury securities²² and other bonds in the financial markets. This was done to stimulate the economy which will lead to higher domestic prices (Strømsheim 2011). So far, this does not seem to have had any impact. The high unemployment should be dealt with directly, not via general monetary easing. Unfortunately, fiscal policy is in a political gridlock. This implies that monetary policy is the only available way of stimulating the economy (Handelsbanken 2010).

After all, the financial crisis was triggered by events that occurred in the American real estate-markets. Rotten mortgages (subprime loans²³) were packed and divided into complicated savings products, and sold to investors all over the world (Isachsen 2008). This illustrates how much influence United States possesses. To summarize, what happens in the USA in the future will be of great importance for the rest of the world.

4.3.2 Emerging markets

Emerging markets are economies that are restructuring their economies along market-oriented lines. These economies offer a wealth of trade opportunities, technology transfers and foreign direct investments. Li (2011) points out four important characteristics that make emerging economies so important. First, they are regional economic powerhouses with large populations and large resource bases. Second, they seek new policies to replace their

²¹ U.S. Bureau of Labor Statistics

²² Government debt issued by the United States Department of the Treasury through the Bureau of Public Debt

²³ Mortgage loans to a person with a poor credit

traditional state policies that have failed to produce economic growth. Third, they are the world's fastest growing economies. Forth, they are critical actors in the world's major political, economic and social affairs (Li 2011).

Emerging markets survived the recession subsequent to the financial crisis in a better way than many of the advanced economies. The current progress of emerging markets like BRICS will allow them to play an important role in the world economy and take more responsibility for economic and financial stability (IMF 2010). The challenges for emerging markets in the coming years are quite different from the ones for advanced economies. As the advanced economies are experiencing low growth, and even deflation, emerging markets needs to be aware of increasing inflation rates and rapid currency appreciation.

Trade between the BRIC member countries has for the most part been denominated in US dollars. This has mainly been due to the dollar's size, stability and liquidity. There have long been speculations on whether the dollar should be discarded as the main currency used for the intra-BRIC trade. This trade has been growing by 30% since 1999, and currently accounts for 8% of global trade (China Daily 2011). In April 2011 the speculations became a reality as Brazil, Russia, India, China and South Africa signed an agreement saying that all future trade between them will be conducted in their own currencies (E24 2011). As we have mentioned previously, exchange rates are determined by supply and demand. The newly signed agreement between the BRICS will leave a reduction in the demand for dollars, whereas supply and demand dynamics implies a depreciation of the dollar. If the intra-BRICS trade continues to grow at the current rate of 30% and this is conducted in the local currency rather than dollars, the downward pressure on the dollar will amplify.

In 2009 the BRICS represented 11.6% and 3.8% of all Norwegian imports and exports (European Commission 2011), hence the cumulative demand for Norwegian goods today is relatively small. The BRICS impact on the value of the NOK, can therefore be said to be small.

Emerging economies must start to value their relationship with USA instead of confronting it. They must realize their emergence peacefully, with an open and stable world system. With USA not so confident about its world power anymore, while the BRIC's are, Canrong (2011) argue that these mindsets could cause misjudgments by standing in the way of USA to maintain their hegemony and the rise of emerging economies. He argues that the future

depend on two factors; One, whether the USA is willing to let the emerging economies develop and take part in the world system where old and new powers have an equal say in negotiations. Two, whether the emerging economies can understand the difficulties of power transition, secure a peaceful development and co-operation (Canrong 2011).

5. PREDICTION

Economists continue to look for the keys to predict currency exchange rates. Some researchers argue that exchange rates behave like financial assets, whose price movements react to changes in expectations about future fundamental variables, rather than by changes in current ones (Wang 2008). This can be one of the reasons why exchange rates are so hard to predict. There are so many factors involved. Even though, we feel that we have managed to form ourselves a picture of how the NOK/EUR relationship will appear in 50 to 80 years. Because of the long time horizon, we have decided to divide our prediction into two parts; the short run (2011-2021) and the long run (2021-2090).

For the short run, the factors we find to be most significant are interest rate differential, the petroleum industry and economic growth (GDP). For the long run, we will present inflation level, the petroleum industry, economic prospects and the world economy.

THE SHORT RUN

Table 5.1: NOK/EUR drivers from 2011-2021.

NOK/EUR drivers 2011-2021	Effect
Interest rate differential	↓
Economic growth (real-GDP)	↓
Petroleum industry	↓

The table illustrates the *cet. par.* effect of each of the drivers. A downward effect on the EUR/NOK exchange rate indicates a downward pressure on the EUR or an upward pressure on the NOK.

Interest rate differential:

Currently the key interest rate in Norway is 2.25%, and 1.25% in the Eurozone, giving an interest rate differential of 1%. DnB expects an interest rate differential (main scenario in prognosis) of 2.25%, and an exchange rate of NOK 7.50/EUR in 2014. This is mainly due to expectations of growth in wages and increase in household consumption (E24 2011). The implied effect of an interest rate differential on the exchange rate can be illustrated by the formula presented in part 2.6, in the following matter:

1. *Interest differential of 1% in 2014 (unchanged throughout the period):*

$$p = \left(\frac{1.0225}{1.0125}\right)^3 - 1 = 0.03298, \text{ or } \mathbf{3.3\%}.$$

2. *Interest rate differential of 2.25% in 2014 (1% in 2012, 2% in 2013):*

$$p = \left(\frac{1.0225}{1.0125}\right) \times \left(\frac{1.0325}{1.0125}\right) \times \left(\frac{1.0350}{1.0125}\right) - 1 = 0.05271, \text{ or } \mathbf{5.27\%}$$

3. *Interest rate differential of 1% until 2021:*

$$p = \left(\frac{1.0225}{1.0125}\right)^9 - 1 = 0.09248, \text{ or } \mathbf{9.25\%}$$

$p > 0\%$ implies that the home currency (NOK in this case) should appreciate. $p < 0\%$ implies that the home currency should depreciate.

Historically there has been a positive interest rate differential (from a Norwegian point of view) between Norway and the Eurozone cf. figure 3.4. Between 2004 and 2007 there was primarily no differential, and from 2008 there has been a differential mainly between 1% and

2%. In illustration 3 above, we have calculated the implied appreciation of the NOK against the EUR with an average interest differential of 1%.

The Norwegian economy is expected to grow at a higher pace than the Eurozone. It is therefore likely that the Norwegian interest rate will remain relatively higher than the Eurozone interest rate.

In the latest prognosis from DnB NOR there are expectations of growth in the general Norwegian wage level of 4.8% in both 2012 and 2013 (E24 2011). There are also positive expectations regarding economic growth, investments and household consumption. For the Eurozone the prospects are gloomier. Due to the low growth and a high level of uncertainty, interest rates are expected to be kept low (DnB NOR 2011). Considering current prognosis and the historical relationship, we believe that an average interest rate differential of 1% is plausible for the coming ten years. The implied appreciation of 9.25% in the next 10 years should give an exchange rate of NOK7.069/EUR in 2021, based on today's (26.05.2011) exchange rate of NOK 7.79/EUR.

Petroleum industry:

For the coming ten years, we expect the revenues generated from the petroleum industry to remain at a high level. This is mainly due to the expectations of high oil prices, discovery of new oil fields, increased investments in the petroleum sector and also that a rapid decline in the petroleum production is not anticipated until 2020 (DnB NOR 2011). Together with the positive synergetic effects of the increased oil price, the petroleum industry will have a positive effect (downward pressure on NOK/EUR) on the Norwegian krone for the coming ten years.

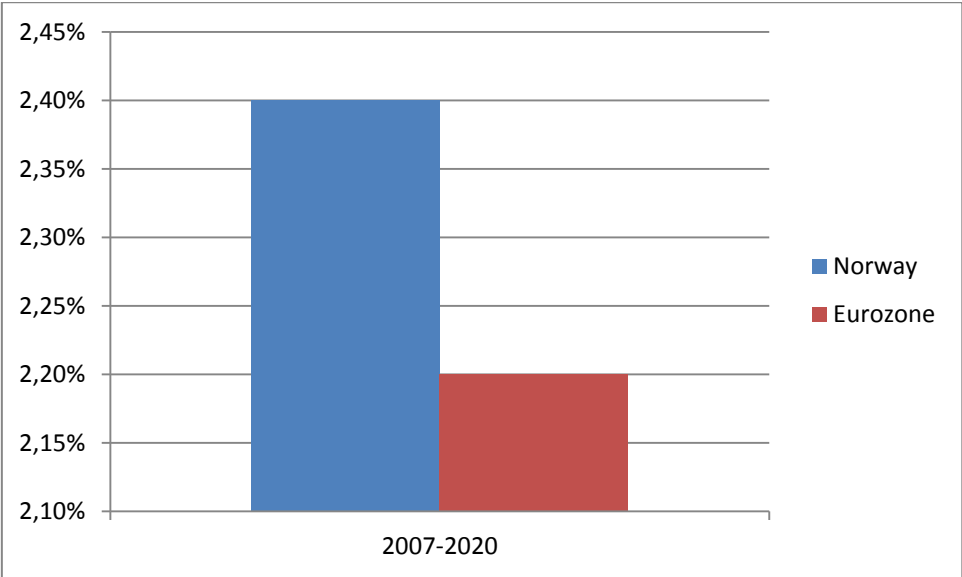
Economic growth (GDP):

According to Fondsfinans, SSB assume that the growth of Mainland Norway GDP will increase from 2% in 2010 to 3% in 2011. The main reason for this is high orders for both the import- and the export industry. Expectations about future revenues are high for Norwegian firms. Increased domestic demand will help to maintain high economic growth and will eventually lead to a positive cycle for Norwegian economy (Fondsfinans 2010).

The outlook for the Eurozone is more uncertain. Germany is the leading country, boosted by exports and corporate investments. Other parts of the Eurozone are at a more critical stage. The budget cuts in Portugal, Ireland, Spain and Greece are set to weigh down economic growth. The debt situation will continue to depress the domestic demand for the coming years (Handelsbanken 2011). A report published by the European Commission (March 2011) argue that the GDP growth for the Eurozone will be of 1.6% in 2011, slightly above the previously forecast growth rate of 1.5%.” *While exports should continue supporting the recovery, a rebalancing of growth toward domestic demand is expected for 2011, resulting in more sustainable growth*”, the executive arm of the 27-member union said in the report. The report also pointed out that growth will be uneven across the member countries (International Business Times 2011).

The prospects for the Norwegian economy are more positive than for the Eurozone in the coming ten years. A higher GDP growth implies a higher future interest rate in Norway. The effects of the different prospects should be a downward pressure on the NOK/EUR relationship.

Figure 5.1: Estimated GDP for Norway and the Eurozone.



Source: (European Commission 2009)

THE LONG RUN

Table 5.2: NOK/EUR drivers from 2021-2090.

NOK/EUR drivers 2021-2090	Effect
Inflation	↑
Petroleum industry	↑
Economic prospects	↓
World economy; USA and emerging markets	→

The table illustrates the *cet. par.* effect of each of the drivers. A downward effect on the NOK/EUR exchange rate indicates a downward pressure on the EUR and an upward pressure on the NOK.

Inflation:

In part 2.7 we established that PPP is supported by empirical tests, and is assumed to hold for Norway. This gives that in the long run, the exchange rate between two currencies, will adapt according to the relative price level in the two countries. Below are the official monetary policies for the European Union and Norway, indicating the implied long term growth in price levels.

The monetary policy of the European Central Bank:

“The primary objective of the ECB’s monetary policy is to maintain price stability. The ECB aims at inflation rates of below, but close to, 2% over the medium term”
(ECB 2011)

The monetary policy of the Norwegian central bank (Norges Bank):

“The operational target of monetary policy shall be annual consumer price inflation of close to 2.5 per cent over time. Monetary policy shall also contribute to stabilizing output and employment.”(Norges Bank 2008)

If the inflationary target of 2% and 2.5% for the EU/Eurozone and Norway respectively, is maintained and holds on average, the implied cet. par. effect suggested by PPP can be calculated using the formula presented in part 2.7:

$$e_f = \left(\frac{1+I_h}{1+I_f}\right)^{80} - 1 = \left(\frac{1.025}{1.02}\right)^{80} - 1 = 0.4788 \text{ or } 47.88\%$$

0% < implies that the foreign currency (EUR in this case) should appreciate. 0% > implies that the foreign currency should depreciate.

Based on today's (26.05.2011) exchange rate of NOK 7.79/EUR, PPP suggests an exchange rate of NOK 11.52/EUR in 80 years. Although it seems unlikely that the NOK should depreciate by almost 50% against the euro, the effect of the negative inflationary differential (from a Norwegian point of view) is an upward pressure on the NOK/EUR, a depreciation of the NOK against the EUR.

The petroleum industry:

Though fish and minerals are important export goods for Norway, they are of marginal significance compared to oil and gas. Norway does not currently have any other natural resources, or other goods, that can replace the petroleum industry. It is therefore more than likely that the current trade surplus will converge towards a trade deficit from around 2020. Exactly when a trade deficit will occur is however uncertain.

Previously we described the positive synergetic effects of a rise in the oil price and increased investments in the petroleum industry. As the activity in this sector is expected to decrease substantially in the long run, there will necessarily be negative effects of this. Suppliers (to the oil industry) will experience diminishing demand, which will affect the demand for labor, and consequently result in a negative effect on the GDP.

The inevitable scaling down of the petroleum industry will leave a lot of workers without a job. Some of this surplus is expected to find its way to the public sector, as the group of people over 67 years of age is expected to double in the coming fifty years.

We also believe that a diminishing petroleum industry could have a psychological effect. The petroleum industry has given Norway a significant position in the world economy, because of positive expectations about the future. When the "oil adventure" comes to an end, we fear that there might some sort of a "recoil-effect". This is what happened in the Netherlands in the

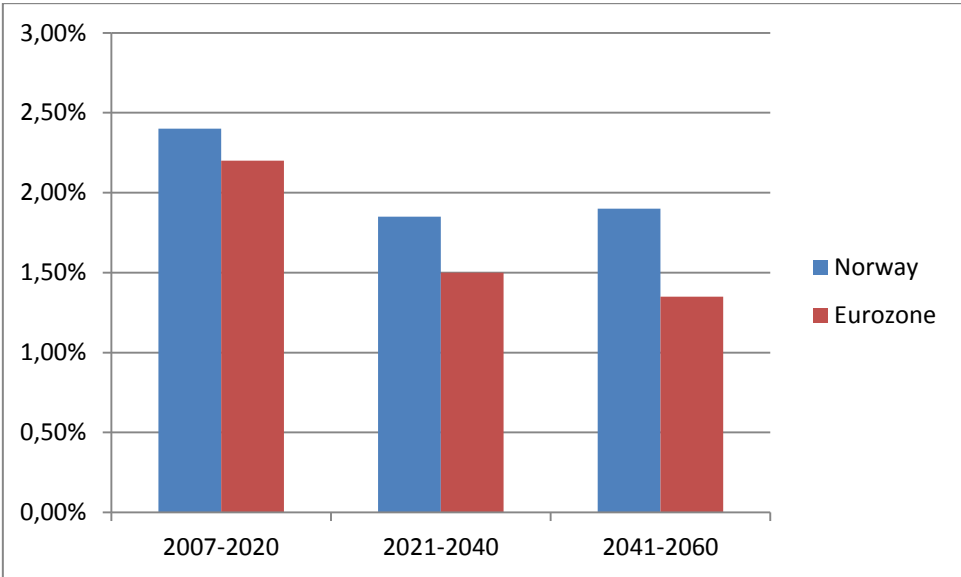
1960' and 70's, and is referred to as *the Dutch disease*. The Dutch disease denotes the challenges countries with temporary natural resources revenues can experience in terms of increased costs and a large public sector. When revenues decrease, the restructuring problems could become painful (Johnsen 2010).

The effect of a reduced petroleum industry on the NOK is a downward pressure due to the resulting decrease in demand for NOK.

Economic prospects:

In both the Eurozone and in Norway, the demographic changes will impose challenges in the future, resulting in decreased working forces. As a consequence the productivity growth is expected to decrease in the long run. Generally, a high GDP-level creates expectations of high interest rates due to the positive effects (e.g. employment and income level). From the projections on GDP growth done by ECB, we can see that Norway is expected to experience a higher growth than the Eurozone.

Figure 5.2: Projected growth in GDP for Norway and the Eurozone.



Source: (European Commission 2009)

The cet. par. effect of the future economic prospects implies an appreciation of the NOK against the EUR in the long run, hence a downward pressure on the NOK/EUR relationship.

The world economy:

Norway and Europe is a part of the larger picture, the world. How the world economy in general could influence the NOK/EUR relationship, is hard to predict. Nevertheless, we believe that the state of the world economy must be taken into account when we make our prediction. A healthy future world economy will provide better conditions for both Norway and the Eurozone. We have previously stated that the American economy is the largest national economy. The world is dependent on demand from USA and also on goods/services produced in USA. Likewise, emerging economies will play an important role in the future.

There is no doubt that emerging markets and USA will have a strong influence on the world economy, and also an impact on the NOK/EUR exchange rate. It is however hard to detect a distinct relationship. No matter how big the influence of emerging economies will be in the future, or in what way the American economy will develop, it is currently impossible to predict how such changes can influence the NOK/EUR relationship. This is because we do not have the right foundation to analyze the impact of such potential changes.

The NOK/EUR trend - 2011-2090:

In the coming ten years the petroleum industry and projections on the Norwegian economy relative to the Eurozone, implies an appreciation of the NOK against the EUR. If we were to predict a trend for the NOK/EUR exchange rate for the coming ten years, we believe a convergence towards NOK7.069/EUR is plausible. The interest rate differential between NOK and EUR is the main driver, combined with increased oil prices and a maintained high level of petroleum revenues.

In the long run (20-80 years) the inflation rate differential and PPP together with expectations of decreased activity in the oil sector, and no real substitutes, will lead to a weaker NOK. Even though relatively higher GDP growth is expected for Norway, we do not believe this is enough to fully offset the depreciating effect of inflationary differences implied by PPP. It is impossible to determine an exact rate, especially for a time horizon of 80 years, but a convergence towards NOK 11.52/EUR, is likely. Though we cannot be certain that the exchange rate will reach NOK 11.52/EUR, the macroeconomic forces imply a relatively strong depreciation of the NOK in the coming 80 years.

6 CONCLUSION

In our thesis we have assessed the long term exchange rate relationship between Norway and the Eurozone. We have chosen a theoretical analysis, rather than a more technical econometric approach. This is due to the complexity and the uncertainty involved in making projections for such a long time horizon. There is little empirical data available for the time horizon used in our thesis, hence the choices we have made and the factors we have included, are based on our own opinions and the knowledge we have acquired throughout our studies.

It is impossible to predict the exact exchange rate for tomorrow and even harder for the next eighty years. We have considered the generally acknowledged drivers of the NOK, and evaluated their predictive abilities for a long time horizon. Further we have discussed the macroeconomic forces, trying to establish an economic picture for the coming years.

Our findings are that in the coming ten years (2011-2021), the NOK will appreciate against the euro. This is mainly due to the expected interest rate differential, but also due to favorable economic prospects and a remained high level of activity in the petroleum sector. For the following 70 years, we believe that the NOK will experience a strong depreciation against the euro. This is due to the relationship between inflation rates and exchange rates, implied by PPP. Also, a reduced petroleum industry suggests a depreciation of the NOK.

Though a long term currency exchange rate prediction like ours is based on a poor empirical foundation, we believe that we have included the most important factors relevant to reach our objective. This can arguably be referred to as a subjective opinion, and we encourage to further research on the topic.

Bibliography

Agder Energi (2010). Annual Report 2009.

Akram, Q. F. (2000). "PPP despite real shocks: an empirical analysis of the norwegian real exchange rate." Retrieved 20.04, 2011, from <http://www.economics.ox.ac.uk/research/WP/PDF/paper030.pdf>.

BBC (2011). "Will Brics strengthen South Africa's economic foundations." Retrieved 04.05, 2011, from <http://www.bbc.co.uk/news/world-africa-12113830>.

Bergo, J. (2004). "Oljepris, konjunkturer og pengepolitikk." Retrieved 12.11, 2004, from <http://www.norges-bank.no/no/om/publisert/foredrag-og-taler/2004/2004-11-12/>.

Bjørnland, H. (2011). "- Mer avhengig av oljen enn vi tror." Retrieved 17.04, 2011, from <http://www.abcnyheter.no/abc-penger/okonomi/110106/mer-avhengig-av-oljen-enn-vi-tror>.

BLS (2011). Retrieved 20.04.11, 2011, from <http://www.bls.gov/>.

Canrong, J. (2011). "The Essence of the Rise of BRICS and Its Future." Retrieved 29.05, 2011, from <http://www.chinausfocus.com/slider/the-essence-of-the-rise-of-brics-and-its-future/>.

Cappelen, Eika, et al. (2010). "Nedbyggingen av petroleumsvirksomheten." Statistisk Sentralbyrå.

China Daily (2011). "BRICS can build common currency ". Retrieved 18.05, 2011, from http://europe.chinadaily.com.cn/epaper/2011-04/08/content_12291921.htm.

Chinn, M. D. and G. Meredith (2005). Testing Uncovered Interest Parity at Short and Long Horizons during the Post-Bretton Woods Era, National Bureau of Economic Research, Inc, NBER Working Papers: 11077.

The hypothesis that interest rate differentials are unbiased predictors of future exchange rate movements has been almost universally rejected in empirical studies. In contrast to previous studies, which have used short-horizon data, we test this hypothesis using interest rates on longer-maturity bonds for the U.S., Germany, Japan and Canada. The results of these long-horizon regressions are much more positive %u2013 the coefficients on interest differentials are of the correct sign, and most are closer to the predicted value of unity than to zero. These results are robust to the use of different data frequencies, sample periods, yield definitions, and base currencies. We appeal to an econometric interpretation of the results, which focuses on the presence of simultaneity in a cointegration framework.

CIA (2011). "Country comparison GDP (PPP)." Retrieved 22.04, 2011, from <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2001rank.html>.

CIA (2011). "Field Listing :: GDP (purchasing power parity)." Retrieved 03.05, 2011, from <https://www.cia.gov/library/publications/the-world-factbook/fields/2001.html>.

CIA (2011, 17.05.11). "The world factbook." Retrieved 28.05, 2011, from <https://www.cia.gov/library/publications/the-world-factbook/geos/us.html>.

Cunningham (2005). Lecture 3.

Dagens Næringsliv (2011). "Nå er Norge Sveriges viktigste handelspartner." Retrieved 21.05, 2011, from <http://www.dn.no/forsiden/utenriks/article1817531.ece>.

Den norske EU-delegasjonen (2011). "Handelspolitikk." Retrieved 15.04, 2011, from http://www.eu-norge.org/Norges_forhold_til_EU/Politikkomrader/handelspolitikk/.

DnB (2011). "Economic Outlook." Retrieved 21.04, 2011, from <https://www.dnbnor.no/portalfront/nedlast/no/markets/analyser-rapporter/engelske/economic-outlook/EO1101.pdf?popup=true>.

DnB (2011). "Fortsatt utsikter til svakere euro." Retrieved 18.04, 2011, from <https://www.dnbnor.no/bedrift/markets/nyheter/110218-euro.html>.

DnB (2011). "Høyere oljepris har gitt sterkere krone." Retrieved 12.04, 2011, from <https://www.dnbnor.no/bedrift/markets/nyheter/110223-nok-olje.html>.

DnB (2011). "Sterk Euro tross gjeldsuro." Retrieved 16.04, 2011, from <https://www.dnbnor.no/bedrift/markets/nyheter/110329-euro.html>.

DnB NOR (2011). "Høyere oljepris har gitt sterkere norsk krone." Retrieved 23.02., 2011, from <https://www.dnbnor.no/bedrift/markets/nyheter/110223-nok-olje.html>.

DnB NOR (2011). "Oppsvinget holder, men ennå langt igjen ". Retrieved 26.05, 2011, from <https://www.dnbnor.no/portalfront/nedlast/no/markets/analyser-rapporter/norske/okonomiske-utsikter/110511-makroprognoser.pdf?popup=true>.

E24 (2011). "Da blir det slutt for dollarens dominans." Retrieved 24.05, 2011, from <http://e24.no/makro-og-politikk/da-blir-det-slutten-paa-dollarens-dominans/20047951>.

E24 (2011). "Kronen er for billig." Retrieved 26.05, 2011, from <http://e24.no/makro-og-politikk/kronen-er-for-billig/20056398>.

ECB (2011). "Monetary Policy." Retrieved 26.04, 2011., from <http://www.ecb.int/mopo/html/index.en.html>.

Eriksrud, A. M. (2011). – Regjeringen sier nei til konsekvensutredning, TV2 Nyhetene.

European Commission (2009). "2009 Ageing Report." Retrieved 18.05, 2011, from http://ec.europa.eu/economy_finance/publications/publication14992_en.pdf.

European Commission (2009). "2009 Ageing Report." Retrieved 30.05, 2011, from http://ec.europa.eu/economy_finance/publications/publication14992_en.pdf.

European Commission (2010). "International trade in goods." Retrieved 22.04, 2011, from http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/International_trade_in_goods.

European Commission (2011). "Bilateral relations - statistics." Retrieved 20.04, 2011, from <http://ec.europa.eu/trade/creating-opportunities/bilateral-relations/statistics/>.

European Commission (2011). "EU BILATERAL TRADE AND TRADE WITH THE WORLD." Retrieved 17.04, 2011, from http://trade.ec.europa.eu/doclib/docs/2006/september/tradoc_113429.pdf.

European Commission (2011). "The euro." Retrieved 15.02., 2011, from http://ec.europa.eu/economy_finance/euro/index_en.htm.

European Commission (2011). "Why the euro?". Retrieved 15.02, 2011, from http://ec.europa.eu/economy_finance/euro/why/index_en.htm.

Federal Reserve Bank of New York (2011). "The main participants in the Market." Retrieved 04.05, 2011, from <http://www.ny.frb.org/education/addpub/usfxm/chap4.pdf>.

Finansdepartementet (2011). "Norges olje- og gassressurser." 2011, from http://www.regjeringen.no/nb/dep/oed/tema/olje_og_gass/norges-olje-og-gassressurser-.html?id=443528.

Fondsfinans (2010). Økonomiske utsikter for 2011.

fxTRADE, O. (2011). "Benefits of Forex Trading." Retrieved 22.01., 2011, from <http://fxtrade.oanda.com/learn/intro-to-currency-trading/benefits/trading>.

Gjedrem, S. (2001). "Inflasjonsmål - hvordan settes renten." Retrieved 07.04, 2011, from <http://www.norges-bank.no/no/om/publisert/artikler-og-kronikker/art-2001-05-29html/>.

Gjedrem, S. (2009). "Investing in the long run." Statistisk Sentralbyrå(03.06.2009).

Gyntelberg, J. and E. M. Remolona (2007). "Risk in carry trades: a look at target currencies in Asia and the Pacific." BIS Quarterly review.

Handelsbanken (2010). Global macro forecast.

Handelsbanken (2010). "Macro Forecast." Retrieved 18.04, 2011, from <http://research.handelsbanken.se/Attachments/14171/Global%20Macro%20Forecast%202%20december%202010.pdf>.

Handelsbanken (2011). Macro forecast.

Holden, P. (2007). "Current account deficits end exchange rates." Retrieved 04.05, 2011, from <http://www.youtube.com/watch?v=yCjwXz7ZXwU>.

Höök and Aleklett (2008). A decline rate study of Norwegian Oil Production, Uppsala university.

Håland, J. (2003). Holder udekket renteparitet.

IMF (2009). "Regional economic Outlook. Europe. Addressing the crisis." Retrieved 21.04, 2011, from <http://www.imf.org/external/pubs/ft/reo/2009/eur/eng/ereo0509.pdf>.

IMF (2010). Retrieved 28.04, 2011, from <http://forums.imf.org/showthread.php?t=11150>.

IMF (2010). "Emerging Markets Drive Global Economy." Retrieved 22.04, 2011, from <http://www.imf.org/external/pubs/ft/survey/so/2010/new120910a.htm>.

IMF (2011). "World Economic Outlook." Retrieved 16.04, 2011, from <http://www.imf.org/external/pubs/ft/weo/2011/01/pdf/text.pdf>.

Index Mundi. "Norway - current account balance." Retrieved 04.05, 2011, from <http://www.indexmundi.com/facts/norway/current-account-balance>.

International Business Times (2011). "EU raises euro area GDP growth forecast for 2011." Retrieved 27.05, 2011, from <http://www.ibtimes.com/articles/117397/20110301/euro-zone-gdp-growth-forecast-european-union-commission-2011-outlook.htm>.

Isachsen, A. J. (2008). Om finanskrisen i USA.

Isard, P. (2006). Uncovered interest parity. Working paper IMF. 06/96.

Johnsen, S. (2010). "Sunne tiltak mot hollandsk syke." Retrieved 30.05, 2011, from http://www.regjeringen.no/nb/dep/fin/aktuelt/taler_artikler/ministeren/taler-og-artikler-av-finansminister/2010/Sunne-tiltak-mot-hollandsk-syke.html?id=593648.

Ketels, C. (2011). "Norway's role in the global economy of the 21st century – key policy issues." Retrieved 23.05, 2011, from <http://www.regjeringen.no/nb/dep/ud/kampanjer/refleks/innspill/oekonomi/ketels.html?id=493172>.

Krugman, P. R. and M. Obstfeld (2006). International economics: theory and policy. Boston, Mass., Pearson.

Kom ut i 2005

Li, C. (2011). "What Are Emerging Markets?". Retrieved 28.05, 2011, from http://www.uiowa.edu/ifdebook/faq/faq_docs/emerging_markets.shtml.

Lund, K. (2011). Felles front mot Vesten. Dagens Næringsliv: 36.

Madura, J. and R. Fox (2007). International financial management. London, Thomson Learning.

Mork, Bache, et al. (2011). "It's getting better all the time." Handelsbanken Capital Markets(1. April).

Naug, B. E. (2003). "Faktorer bak utviklingen i kronekursen – en empirisk analyse." Retrieved 10.04, 2011, from <http://www.norges-bank.no/upload/import/publikasjoner/skriftserie/skriftserie-31/kap7.pdf>.

NBIM (2011). Retrieved 06.04, 2011, from <http://www.nbim.no/en/About-us/Government-Pension-Fund-Global/>.

NHO (2010). Velferdsfellen, Næringslivets Hovedorganisasjon.

Norges Bank (2008). "The objective of monetary policy." Retrieved 26.04, 2011, from <http://www.norges-bank.no/en/price-stability/monetary-policy-in-norway/the-objective-of-monetary-policy/>.

Norges Bank (2010). "Activity in the Norwegian foreign exchange market and derivatives market in April 2010." Bank for International Settlements.

Norges Bank (2010). "Noregs Banks historie." Retrieved 03.05, 2011, from <http://www.norges-bank.no/no/om/historie/noregs-banks-historie/>.

Norges Bank (2011, 01.02.2011). "Beregnete kurser." Retrieved 10.03, 2011, from <http://www.norges-bank.no/no/prisstabilitet/valutakurser/beregnete-kurser---forklaring/>.

Norges Bank (2011). "FAQ - Monetary policy, inflation and interest rates." Retrieved 03.05, 2011, from <http://www.norges-bank.no/en/faq/monetary-policy/>.

Norges Bank (2011, 25.01.2011). "Valutakurser." Retrieved 10.04, 2011, from <http://www.norges-bank.no/no/prisstabilitet/valutakurser/>.

NTB (2010). "Oljefondet ikke nok til å møte eldrebølgen." Retrieved 17.12., 2010, from <http://www.aftenposten.no/okonomi/article3953114.ece>.

Oljedirektoratet (2010). Petroleumsressursene i havområdene utenfor Lofoten, Vesterålen og Senja

Oljedirektoratet (2011). "Ressursregnskap for norsk kontinentalsokkel per 31.12.2010 ". Retrieved 12.04, 2011, from <http://www.npd.no/no/Tema/Ressursregnskap-og-analyser/Temaartikler/Ressursregnskap/2010/>.

Olsen, Ø. (2008). Norway and the oil, in a 100 year perspective. S. Sentralbyrå.

Oslo Børs (2011). "Aksjeindekser." Retrieved 11.04, 2011, from http://www.oslobors.no/markedsaktivitet/stockIndexGraph?new_ticker=OSEBX&new_menuCtx=1.6.3.

Papell, D. H. and R. Prodan (2003). "Long Run Purchasing Power Parity: Cassel or Balassa-Samuelson." Retrieved 20.04, 2011, from http://elsa.berkeley.edu/~obstfeld/281_sp04/papell.pdf.

Popp, A. (2006). "The Effects of Natural Disasters on Long Run Growth " (University of Northern Iowa).

Pugel, T. A. and P. H. Lindert (2000). International economics.

Q. Farooq Akram, K.-M. B., Raymond Lokshall (2003). "Explaining movements in the Norwegian exchange rate." Norges Banks Skriftserie/Occasional papers No. 32.

Regjeringen (2010, 11.2011). "Norsk oljehistorie på 5 minutter." from http://www.regjeringen.no/nb/dep/oed/tema/olje_og_gass/norsk-oljehistorie-pa-5-minutter.html?id=440538.

Regjeringen (2011). Retrieved 11.04, 2011, from http://www.regjeringen.no/nb/dep/fin/tema/statens_pensjonsfond.html?id=1441http://www.regjeringen.no/nb/dep/fin/tema/statens_pensjonsfond.html?id=1441.

Regjeringen (2011). "Norsk europapolitikk." 2011, from <http://www.regjeringen.no/nb/sub/europaportalen/norsk-europapolitikk.html?id=115260>.

Romstad, M. (2008). "Fant svaret på oljegåte." Retrieved 07.04, 2011, from <http://www.dn.no/energi/article1484448.ece>.

Salvatore, D. (2004). International economics. New York, Wiley.

Skidmore, M. and H. Toya (2002). "Do natural disasters promote long-run growth?" Skidmore & Toya : Disasters and growth(2002).

Solheim, H. (2008). "Virkninger av økt oljepris på norsk økonomi." Norges Banks publikasjoner.

SSB (2011). "Decreased oil production in 2010." Retrieved 12.04, 2011, from http://www.ssb.no/english/subjects/10/06/20/ogprodre_en/.

SSB (2011). "Olje og gass." Retrieved 12.04, 2011, from http://www.ssb.no/olje_gass/.

SSB (2011). "Statistikkbanken." Retrieved 09.04., 2011, from http://statbank.ssb.no/statistikkbanken/Default_FR.asp?PXSid=0&nvl=true&PLanguage=0&tilside=selecttable/hovedtabellHjem.asp&KortnavnWeb=muh.

SSB (2011). Økonomiske Analyser 01/11.

Strømsheim, G. (2011). - Det hjalp ikke å trykke 600 milliarder dollar Aftenposten.

The Federal Reserve (2011). The Federal Reserve in the International sphere. The Federal Reserve System: Purposes and Functions.

Thomson Reuters (2011). Datastream.

Trading Economics (2011). Retrieved 06.05, 2011, from <http://www.tradingeconomics.com/>.

Utenriksdepartementet (2011). "Landsider." Retrieved 21.04., 2011, from <http://www.landsider.no/land/usa/fakta/okonomi/>.

Wang, J. (2008). "Why Are Exchange Rates So Difficult to Predict?". Retrieved 26.05, 2011, from <http://dallasfed.org/research/ecllett/2008/e10806.html#1>.

XE (2011). "What is currency trading?". Retrieved 20.01., 2011, from <http://www.xe.com/currencytrading/>.

Østby, L. (2004). "Den norske eldrebølgen: Ikke blant Europas største, men dyrt kan det bli." Statistisk Sentralbyrå.