



The Norwegian Krone
Impacts of Oil Price Changes and the Sovereign Wealth Fund
Transactions

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LIST OF ABBREVIATIONS

EFTA	European Free Trade Association
DD	Dutch Disease
GDP	Gross Domestic Product
GPIFG	Government Pension Fund Global
IMF	International Monetary Fund
LNG	Liquified Natural Gas
log	Natural logarithm
NBIM	Norges Bank Investment Management
NOK	Norwegian Krone
OECD	Organisation for Economic Co-operation and Development
SD	Standard deviation
SWF	Sovereign Wealth Funds
USD	United States Dollar
VAR	Vector Auto Regression

1 INTRODUCTION

For centuries Norwegian citizens earned their living through sailing, fishing or farming, so that at the beginning of the 20th century, Norway was still a rather poor country compared to other European countries, as well to their Scandinavian neighbors, Denmark and Sweden (Hodne, 1983, p.1). After the World Wars, Norway joined the ‘Organisation for Economic Co-operation and Development’ (OECD), and the ‘European Free Trade Association’ (EFTA) in 1960 which opened the European market for Norwegian industries (Hodne, 1983, P. 181). Manufacturing industries emerged and the foundation for the Norwegian Welfare state was built, including housing, education and National Security (Hodne, 1983, p.241). Still in the 1950s there was not expected to find oil on the Norwegian shelf, however about a decade later, the oil started to slowly appear on Norway’s radar (Norwegian Offshore Directorate, 2025a).

Holt-Jensen documented the beginning of the Norwegian oil economy in his paper from 1981 and defined the following 4 phases (Holt-Jensen, 1981, pp.81-82). The first phase began when in 1962 foreign oil companies assumed, due to testing in the Norwegian Sea, that the country has high reserves of natural resources in their soil. In the following years, the Norwegian Government allocated licenses for oil companies, to manage the upcoming industry. The discovery of the Ekofisk oilfield in 1969 marks phase 2 in Norway’s oil history. This led the Government to set up the Norwegian Petroleum Directorate in 1972, along with the state-owned oil company Statoil (Hodne, 1983, p.252). From the beginning the Norwegian Government wanted to maintain the royalties in the oil business and limit the shares in the industry for foreign companies. Therefore, in 1974, the government set up the policy “Petroleum industry in Norwegian Society” to officially rule the oil industry. This policy marks phase 3 of the industry and focuses specifically on the usage of revenue for public infrastructure, the democratic and state-owned administration, taxation, research and development and the levels of production (Norwegian Ministry of Finance, 1974, pp.7-55). The fourth and last phase began in 1980 when the first drilling took place and new oilfields were commercialized. From there on the increasing oil industry had an immense impact also on Norway’s mainland economy. The Krone gained value due to rising oil revenue, which caused sinking exports of other products than oil. Soon the economy stagnated in remaining industries such as ship building, forest and other manufacturing businesses (Hodne, 1983, pp.257-259).

Since the 1980s, the oil industry in Norway is constantly growing, not in particular in volume of production but rather in direct and indirect services associated with the industry. The sector is growing constantly, as many companies additionally sell their services far beyond the borders of Norway (Norwegian Offshore Directorate, 2024b). The service sector around the main income, the selling of natural resources, has now developed into the second largest sector within Norway's economy (Norwegian Offshore Directorate, 2024b). Despite Norway's oil and gas exports only cover 2-3% of the global demand, Norway is among the most important exporters, especially for Europe (Norwegian Offshore Directorate, 2024a). It makes up around 50% of the value of exports in Norway (see Figure 6). According to the Norwegian Petroleum Directorate the production has now, after 50 years, reached its halftime, while approximately 56 % of the total estimated resources have been used already (Norwegian Offshore Directorate, 2025b). For the distant future, the production output depends highly on new oil field discoveries and their fast implementation as production sites.

Looking at the high stake the oil production holds in Norway's economy, one could assume that not just the economy is dependent on the production and oil prices, but also other macroeconomic measures, such as the exchange rate. As oil prices are usually highly volatile (Amar, Lecourt and Kinon, 2017, p.7), a strong dependency on oil is expected to transmit high fluctuation to other economic channels as well. It is therefore obvious, why countries with a boom in resources fear the resource curse and further the Dutch Disease (DD), a phenomenon accompanying rapid commodity booms, that destabilize the economy. The first time that this event occurred was in the Netherlands, when in the 1960s, gas fields were discovered (Bjørnland and Thorsrud, 2014, p.2). It is often argued that the establishment of SWF prevent the destabilization of the economy. The word 'buffer' is often used in connection with SWFs. It the SWF is said to have a buffer function to shield external shocks and crises (Hasse, Lecourt and Siagh, 2024, p.41). To secure the oil revenue as wealth for future generations and prevent the stagnation of other industries, that started to show in the late 1980s, the Norwegian implemented a sovereign wealth fund in 1990. The fund is investing all its inflows in foreign investments in order to not affect the Norwegian economy by domestic investments and create the highest possible value according to the benchmark set by the Ministry of Finance every year (NBIM, 2025a).

The Government Pension Fund Global (GPF) has ever since gained much popularity, being one of the biggest sovereign asset accumulations in the world. With a value of nearly 1.6 trillion USD, it headed the list of SWFs worldwide (see Figure 9). For nearly 30 years it accumulates the revenue of the Norwegian oil production in order to invest abroad and increase its own value. But to what extent has the GPF proven to stabilize the domestic economy or further prevent crises and shocks from affecting the economy negatively? Or does the GPF solely act as a pension fund for future generations? Together with the movements in oil prices, the performance of the SWF seems central for the Norwegian economy. This work aims to give insights to the interaction between oil prices, the exchange rate, the gross domestic product (GDP) and the Norwegian SWF, in order to explain and understand how the Norwegian economy handles crises and shocks. Combining the objectives, the thesis investigates the following question:

To what extent do oil price fluctuations and the use of the sovereign wealth fund influence the stability of the Norwegian Krone and Norway's economic development?

The following contents are organized as follows: Chapter 2 provides the theoretical foundation for the empirical part in chapter 3. It includes the basics of exchange rate theory in section 2.1, commodity and oil price dynamics in section 2.2, external shocks and crises in section 2.3 and lastly sovereign wealth funds in section 2.4. Each section provides additional insights on Norwegian examples. The empirical part continues in chapter 3, with the introduction of the hypotheses, that the following analysis will be based on. The data used is described in section 3.1, followed by the methodology in section 3.2. Afterwards the empirical results will be presented in section 3.3 and further discussed in section 4. Thereby recent and relevant literature will be involved and classify the outcomes of the previous section. Lastly the limitations of this thesis will be displayed in section 5.

2 THEORY

When examining the influence of SWFs and oil prices on the exchange rate and the economic performance of a country, a theoretical framework is required to give the research a foundation to build upon. In order to examine the buffer function of the fund on resource exporting economies, the linkages between currency and oil prices as well as economy and oil prices must be explained beforehand. Additionally, the relation of external shocks and crises to the economy of resource-rich countries must be displayed, to understand how an SWF may intervene as a protection mechanism. Different economic indicators enable the assessment of a country's economic performance. The most important indicator to measure the performance is the Gross domestic product (GDP) expressed in growth rates, inflation adjusted, as is it used in economic research as for example in Bjørnland (Bjørnland, 2004, p.36).

2.1 Exchange Rate Theory

In order to understand why exchange rates are considered in this thesis, a theoretical foundation will be provided to show the basic mechanisms of exchange rates and their driving forces. For a small open economy such as Norway (Bjørnland, 2004, p.23) the exchange rate regime can be crucial. Furthermore, the link between a country's macroeconomic performance and exchange rates will be explained. When referring to the term 'exchange rate', one must differentiate nominal and real exchange rates, as well as bilateral and effective exchange rates. The nominal exchange rate expresses the domestic currency price of a foreign currency (Rogoff, 1996, p.649). The real exchange rate on the other hand is the relative cost of a basket of goods between two countries (Obstfeld and Rogoff, 1996, p.200). It therefore represents the nominal exchange rate with adjusted national price-level differences (Rogoff, 1996, p.647). Both can be expressed in bilateral or effective form. When talking about a distinct exchange rate between two countries, for example the United States Dollar (USD)/Norwegian Krone (NOK) exchange rate, it usually refers to the bilateral rate. When comparing the value of a currency to multiple currencies, mainly their trade partners, the rate is called effective exchange rate¹

The origin of the exchange rate theory lies in the Law of One Price (LOP). It suggests that identical goods must have the same price in different countries when these are expressed in

¹ See the definitions for 'Nominal effective exchange rate' and 'Real effective exchange rate' in the IMF Glossary (IMF, 2025).

the same currency (Krugman, Melitz and Obstfeld, 2023, p.453). Based on this theorem, the Purchasing Power Parity (PPP) further includes price levels to explain the relation of prices for identical goods in different countries and currencies. Thereafter, the “exchange rate between two countries’ currencies equals the ratio of the countries’ price levels” (Krugman, Melitz and Obstfeld, 2023, p.454). Whereas the LOP only applies to one traded good, the PPP includes a variety of goods in a basket (Krugman, Melitz and Obstfeld, 2023, p.455).

2.1.1 Exchange Rate Regimes

There are several ways to govern an exchange rate system in an open economy. They represent a broad spectrum, ranging from strictly fixed exchange regimes to freely floating exchange regimes (Anderson, Veyrune and Stone, 2008, p. 42). To understand the mechanisms of different exchange rate regimes, the fixed exchange rate regime must be explained in contrast to flexible exchange rate regimes. The Mundell-Fleming-model illustrates the differences between fixed and flexible exchange rate systems and how fiscal and monetary policy, as well as increasing capital mobility, affect them (Fleming, 1962, p.369; Mundell, 1963, p. 475).

Fixed exchange rates are actively managed by the central bank of a country by actively steering the exchange rate (Mundell, 1963, p.479). Thereafter they purchase and sell reserves in order to adjust the exchange rate during shocks. However, this causes prices to adapt much slower than usual, as they are bound to price stickiness (Chia and Alba, 2006, p.41). How different regimes react to shocks most likely depends on the type of shock the regime is experiencing. Chia and Alba differentiate between nominal and real shocks, meaning shocks coming from within the monetary system, such as changes in money supply or demand on the one hand, and economic shocks such as effects of trade shocks on the other hand (Chia and Alba, 2006, p.42). Facing nominal shocks, the central bank in fixed regimes tries to leave the real output unchanged as it tries to counteract on money demand and supply shifts (Chia and Alba, 2006, p.42). In simpler terms, this means that in case of increasing money demand, the central bank purchases foreign currencies in order to increase the money supply and assure that the exchange rate is unaffected. During real shocks, in order to avoid recession the fixed regime is dependent on the adjustment of domestic prices (Chia and Alba, 2006, p.42). The central bank therefore avoids a depreciation of the nominal exchange rate by reducing the money supply.

In flexible exchange rate regimes the central bank of a country is not allowed to actively intervene in the market to adjust their domestic exchange rate (Mundell, 1963, p. 477). Nominal shocks leave the money supply at the same level, as the exchange rate appreciates, causing the real output to drop and the money demand returning to the previous level (Chia and Alba, 2006, p.42). Whereas during real shocks, such as terms of trade shocks, the flexible rate will depreciate causing the prices for tradable goods to increase and with that counteract the shock (Chia and Alba, 2006, p.42). The free floating exchange rates allow the nominal currency to react immediately to economic shocks, as the relative prices respond with an instant change (Chia and Alba, 2006, p.41). Additionally, the real exchange rate adjustment happens much faster compared to fixed regimes (Chia and Alba, 2006, p.48). From strictly fixed and flexible regimes, there is a huge variety of other regimes, for example the concept of dollarization, where a country has no currency of their own, nor a currency board (Anderson, Veyrune and Stone, 2008, p. 42). In that case the currency is fully anchored to foreign currency as a base currency. Another example are managed float systems, where the currency is floating despite smaller manual adjustments in the exchange rate (Anderson, Veyrune and Stone, 2008, p. 42).

Additionally, the Dornbusch-overshooting-model is based on the findings of Mundell and Fleming and explains that after the currency of an open economy country with flexible exchange rate was hit by a nominal shock, the nominal exchange rate responds immediately. The real exchange rate is also effected in the short-run, however, in the long-run it slowly changes back to the original level (Dornbusch, 1976, p.1173).

2.1.2 The Norwegian Krone

Norway's monetary system has a long history, beginning with the establishing of the first currency the 'speciedaler' in 1816, along with the Norwegian central bank 'Norges Bank' that exists until today (Alstadheim, 2016, p.2). In 1875 Norway joined the 'Scanidavian currency' union which renamed the currency to 'Norwegian Krone' (Alstadheim, 2016, p.3). Since then, the currency switched several times from fixed to floating exchange regimes. At the beginning of the relevant time frame in 1978 the Krone was bound to a pool of currencies, resulting in the linking to the European Monetary System in 1990, while two years later it was allowed to float (Alstadheim, 2016, pp.7-9). The managed floating regime, established in 1994, was replaced by a free floating regime in 2001, which holds until today (Alstadheim, 2016, pp.9-10).

Additionally, it must be explained how the exchange rate is tied to other macroeconomic variables in Norway's case. Akram and Mumtaz (2019) examined the relationship between different macroeconomic factors, including the Norwegian exchange rate within the Norwegian economy. Firstly, they found out that there is an increasing negative correlation between the nominal effective exchange rate and the oil price, even though in the early 1990s there seems to be no correlation at all (Akram and Mumtaz, 2019, p.423). The relation between the two variables is time-varying, meaning, due to the high volatility of oil, the correlation is stronger during periods of oil price drops, such as in 1986, 2008 and 2014 (Akram and Mumtaz, 2019, p.423). Furthermore the authors could trace down a correlation between exchange rate changes and interest rates as well as the CPI inflation, in the beginning, however due to the policy adjustment in the early 1990s, it declined ever since (Akram and Mumtaz, 2019, p.423). After the fixed regime was abandoned, the Norwegian government ran a stabilization policy in order to fully switch to a freely floating regime (Akram and Mumtaz, 2019, p.423). As in the case of Norway, a driving factor for commodity exporting countries that can influence the currency are commodity prices, especially the oil price in oil exporting economies. The link between oil and currency is further explained in the following chapter.

2.2 Commodity and Oil Price Dynamics

The foreign exchange rate plays a big role in the economic stability of a country. Besides the politics that regulate the exchange rate regime and restrictions, other factors can also influence the exchange rate. One important variable for resource-rich countries whose economy depends highly on a commodity, can be the world's commodity prices for this good. The IMF defines 'resource rich' countries as countries who earn 20-25 percent of their fiscal revenue through natural resources (Baunsgaard, *et al.*, 2012, p.6). Norway's most valuable commodities are oil and natural gas, accounting for around 21 % of the country's GDP and 32% of the total revenue estimates 2025 (see Figure 7), which makes Norway a resource-rich country according to the IMF's definition. When talking about the Norwegian oil industry, this mostly includes not only crude oil and petroleum, but also natural gas. While for a long time, the oil was predominantly in export quantity in the natural resource sector, in 2021 gas exports surpassed the oil significantly (see Figure 1).

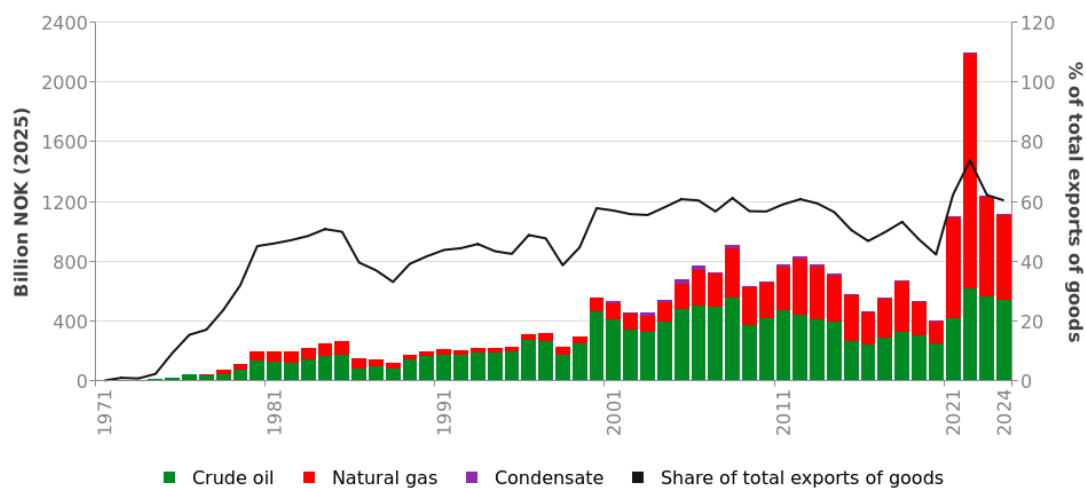


Figure 1 : Export value of Norwegian Petroleum, 1971-2024
 Source: (Norwegian Offshore Directorate, 2024a)

Norway delivers around 30 percent of the total gas consumption of the EU and UK and was the 4th biggest exporter of gas worldwide in 2024 (Norwegian Offshore Directorate, 2024a). Regarding the large share of oil and gas in the fiscal revenue and exports, it is to be expected, that both have a considerable influence on the economic development and the exchange rate.

When dealing with commodities and oil-price-dynamics, the term ‘volatility’ is often mentioned. Commodity prices usually have a high volatility due to low short run elasticities, meaning for instance during short-run elasticities the demand does not drop significantly (Amar, Lecourt and Kinon, 2017, p.7).

Barsky and Kilian identify influencing factors on oil prices as either supply or demand driven, differentiating between supply shocks, aggregated demand shocks and speculative demand shocks (Barsky and Kilian, 2004, pp.16-17). The supply is mainly influenced by geopolitics, OPEC-decision-making, as well as the oil production in itself (Hamilton, 2009, p. 9). While influences through demand can be global macroeconomics and political uncertainty (Barsky and Kilian, 2004, p.20), inflation rates and interest rates (Barsky and Kilian, 2002, pp.164-167; Akram and Mumtaz, 2019, p. 423), as well as the dollar exchange rate (Beckmann and Czudaj, 2013, p.634).

In 1983, Hamilton investigated the link between the oil price and the United States economy, showing that sharp increases in oil prices were frequently followed by periods of recession (Hamilton, 1983, p.229). His study was the first approach to prove the causal effect of oil

prices on an oil-exporting economy, while ruling out alternative endogenous explanations for economic shocks such as prices, money supply or past output behavior (Hamilton, 1983, p.237).

Despite multiple other influences and biases, Chen and Rogoff provide empirical indication, that commodity prices have a significant influence on exchange rates in countries which are highly dependent on this commodity (Chen and Rogoff, 2003, p.155). By looking at the stake the oil industry holds in Norway's economy (see Figure 7), one could argue, that Norway is in fact highly dependent on the revenue of the oil industry. Such countries with a high dependency on commodities, such as oil, are often accused of having a 'commodity currency'. The term is widely used "when the value of the currency of a commodity exporting country moves in parallel with the world commodity price"(Clements and Fry, 2013, p.126). In the past there has been strong indication, that the NOK was at least at some point a commodity currency (Bjørnland and Hungnes, 2005, p.19).

Cashin, Céspedes and Sahay deliver further evidence for the long-term influence of commodity prices on currencies of commodity-dependent countries (Cashin, Céspedes and Sahay, 2004, pp.253-255) The authors also reject the validity of the PPP Puzzle for commodity dependent countries, as they come across more severe and long-lasting shocks than usual economies and the exchange rate during such shocks is adjusted significantly faster to the commodity price than the model suggests (Cashin, Céspedes and Sahay, 2004, pp.260-261). As the Norwegian economy is dependent on the oil industry and both papers mainly examine the impact of commodity prices in general on countries with a high commodity dependency, it is particularly relevant to focus on the distinctive linkage between oil as a commodity and the currency. Beckmann and Czudaj analyze the relationship between oil prices and both real and nominal exchange rates based on a broad spectrum of 26 currencies (Beckmann and Czudaj, 2013, p.624). They find out that changes in the oil price induce long-term adjustments of the real exchange rates by changes in prices (Beckmann and Czudaj, 2013, p.629) and therefore confirm the findings from Chen and Rogoff as well as Cashin et al. concerning the influence of commodity prices on exchange rates.

Furthermore Blattman et al. found out, based on long-term observation of historical data of 35 countries from 1870-1939 (Blattman, Hwang and Williamson, 2007, p.157), that for

commodity-dependent countries the terms of trade² volatility and economic growth have a negative relationship, whereas in industrial countries with stable economies, volatility does not play a significant role (Blattman, Hwang and Williamson, 2007, pp.171-172). Meaning the more volatile the countries terms of trades are, the lesser economic growth is expected. Another important finding is that it depends on the choice of commodity, the economies degree of dependence on that commodity and price trends, how volatile the country's economy is (Blattman, Hwang and Williamson, 2007, p.175) This finding is also supported by van der Ploeg and Poelhekke, who also detect a higher volatility given a high commodity dependency and that some commodities are more volatile than others (van der Ploeg and Poelhekke, 2009, p.732). They also confirm that volatility can have a reverse effect on countries that have a stable economy (van der Ploeg and Poelhekke, 2009, p.746).

As this explains the dynamics of the oil price it is furthermore interesting to look at the relationship between oil and gas prices, since the Norwegian oil production was surpassed by the gas production in 2021. First of all, oil and gas prices differ in their organization and their influencing factors. While oil prices are structured in only a few internationally used benchmarks³, due to its liquidity it can be easily traded worldwide (Norwegian Offshore Directorate, 2024a), the trade of natural gas is much more dependent on the needed infrastructure such as pipelines. This is the case despite the invention on Liquide Natural Gas (LNG)⁴, and is therefore allocated in different benchmarks only used in the specific regions⁵. Due to the regional ties imposed on natural gas, such as the necessary infrastructure, it is much more dependent on political climate, decisions and events, than the oil price (Halser, Paraschiv and Russo, 2023, p.23).

For a long time, it was assumed, that oil and gas prices moved parallel to another, with the gas price being influenced by the oil price and not vice versa. A study by Villar and Joutz (2006) indicated that change in the WTI crude oil price was replicated by the Henry Hub gas price over time, despite decoupling periods (Villar and Joutz, 2006, pp.37-28). They limited their research on the influence of oil prices on gas prices arguing that crude oil is less

² The terms of trade expresses the relation of export to import prices (Blattman, Hwang and Williamson, 2007, p.163).

³ The three largest and mostly used benchmark prices for oil are the Brent crude oil for Europe, the Dubai Fateh for Asia and the West Texas Intermediate for North America (Halser, Paraschiv and Russo, 2023, p.5).

⁴ As LNG is liquified gas, it is not dependent on high-costly infrastructure such as pipelines and therefore can be sold globally (Norwegian Offshore Directorate, 2024a).

⁵ The most important benchmarks for gas are the Dutch Title Transfer Facility, the Platts JKM for LNG in Asia and the Henry Hub for North America (Halser, Paraschiv and Russo, 2023, p.5).

exogenous and therefore gas price influences on oil prices are not relevant (Villar and Joutz, 2006, p.40). However a later study indicates, that in fact there were spillover effects from gas to oil prices until 2006, whereas until 2014 a link between the two variables could not be detected (Batten, Ciner and Lucey, 2015, p.12). Suggestions on why there was no detectable link between the oil and gas industry anymore are centered on the assumption of producer induced supply shocks and new technologies such as hydraulic fracturing and horizontal drilling, which completely transformed the industry (Batten, Ciner and Lucey, 2015, p.15). Halser et al. came to the conclusion, that despite historic linking of oil and gas prices, the relationship of the two variables is time-varying and is highly dependent on the different regions and economic and politic events (Halser, Paraschiv and Russo, 2023, pp.22-23). According to the obtained results especially in times of uncertainty and high volatility, the gas prices in Europe seem to couple with the oil prices for this period. Due to the dominance of the oil production in the selected time frame in Norway, the focus lies on the oil-prices and its influences on the economy, neglecting the gas-price dynamics in further chapters. In addition, the oil-price-dynamics have been extensively analyzed and examined as causes of crises and their effect on resource-rich economies.

2.3 External Shocks and Crises

In the previous two chapters the dynamics and macroeconomic influence of exchange rates and oil prices were reviewed. To provide a theoretical base for the empirical analysis, this chapter deals with how the relevant factors especially influence resource-rich economies through crises. Due to the high dependency on commodities in resource-rich countries, these countries tend to be more sensitive towards several crises.

There are various definitions of the term ‘currency crisis’. In order to deepen the understanding of this term, many authors use statistical measurements to make this definition more precise and relatable. Frankel defines the term in his article from 1996 as “currency crashes”, that are characterized by a 25 % nominal devaluation of the currency while the devaluation rate increases in more than 10 % percent itself (Frankel and Rose, 1996, p.352). Currency crises can be caused by mainly nominal shocks and real shocks (see section 2.1). They affect the economy depending on the type of shock and the type of exchange regime the domestic currency is bound to (Chia and Alba, 2006, p.42).

An important factor for resource-rich countries is the terms of trade. It is proven, that a high commodity term of trade volatility diminishes the economic growth of a country, that has a high dependence on resources (Mohaddes and Raissi, 2017, p.14). Ramey and Ramey found out that growth rates of GDP in general are influenced by the year to year volatility in growth rates (Ramey and Ramey, 1995, p.1140). Meaning when a country already has high volatility in their economic growth measured in GDP, they tend to have lower growth rates overall compared with other countries. This shows the significance of crises and external shocks for resource-dependent countries in contrast to other economies. However when the country has a well-established and developed financial system it is less vulnerable to volatility and shocks, which means that it also depends on the wealth and development stage of a country, whether it can prevent a resource curse or financial crisis (van der Ploeg and Poelhekke, 2009, p.748).

As mentioned in the previous chapter there are many factors that influence the oil price. They can be expressed in different types of oil shocks. Kilian named and structured three types of shocks based on the research of Barsky and Kilian (Barsky and Kilian, 2004, p.16-17) as “oil supply shocks”, “aggregate demand shocks” and “precautionary demand shocks” (Kilian, 2009, p.1054). In further research, the causes for past oil price crises were analyzed with the outcome that most of the crises (1979-1980, 1986, 1990) were caused by speculative demand shocks (Kilian and Murphy, 2014, pp.468-470), while the surge in oil price 2003-2008 was due to flow demand for crude oil caused by the global business cycle, meaning unexpected rapid global economic growth (Kilian and Murphy, 2014, p.467). Often associated with precautionary demand shocks are exogenous political events, as they can have a significant impact on real oil prices through uncertainty of future demand (Kilian, 2009, p.1064). Thus, oil price shocks are, due to the dependency of oil exporting countries on oil, driving factors for the highly volatile oil revenue in these countries. Since the beginning of oil production, there have been several crises that effected the oil price. From 1979 until 1980 several events such as gasoline shortages, the Iranian revolution and the Iran-Iraq war, let the oil price increase significantly (Hamilton, 1983, p.229). Also other political events, such as the invasion of Kuwait in 1990, the beginning of the Afghanistan war in 2001 and the following Iraq war in 2003, let the oil price increase (Barsky and Kilian, 2004, p.15). The global economic boom, especially driven by the fast growth in Asia, lead the oil prices to climb continuously (Kilian, 2009, p.1057) until the global financial crisis in 2008.

Sachs and Warner initially connected countries that are rich in resources with the term “curse”, speaking of a resource curse as huge amounts of natural resources can bring consequences and challenges (Sachs and Warner, 1995, p.4). They furthermore provide evidence of the link between weak economic growth and high resource intensity (Sachs and Warner, 1995, p.15). Being affected by the resource curse leads to the fear of resulting in a DD economy. The term describes the consequences of a boom in resource-rich countries as it happened in the Netherlands in the 1960s after the discovery of gas (Bjørnland and Thorsrud, 2014, p.2). Accordingly, the commodity boom leads profits only to the commodity related industries and businesses in the tradable sector, while other businesses in the lagging sector of the tradable sector have to face the consequences in form of increased wage costs and appreciated exchange rates, resulting in a low competitiveness in the global market (Corden, 2014, p.5). In order to prevent DD and the resource curse in resource-rich countries it is recommended to establish a SWF that allows the government to invest budget surpluses in foreign reserves to enable the domestic economy to develop without direct influence of the surplus (e.g. the natural resources etc.) (Hasse, Lecourt and Siagh, 2024, p.8).

2.4 Sovereign Wealth Funds

Since the early 2000s more and more countries establish SWF in order to manage their budget surpluses and to buffer the effects of oil price volatility, globalization and growing imbalances on the domestic economy (Hasse, Lecourt and Siagh, 2024, p.6). However, due to the broad variety of objectives, sources, governance and policies the different funds have, it is quite challenging to set one explicit definition for the entirety of SWFs (Hasse, Lecourt and Siagh, 2024, p.5). In 2005 Andrew Rozanov was one of the first to define the term of SWF and built a framework of objectives and sources. According to him, SWFs are “a by-product of national budget surpluses, accumulated over the years due to favorable macroeconomic trade and fiscal positions, couples with long-term budget planning and spending restraint” (Rozanov, 2005, p.52). In 2007 the IMF characterized SWFs as accumulated foreign assets that are held by the state for a long term period and are categorized in sources of income and objectives to serve (IMF, 2007, p.45). Following this first approach, the International Working Group of Sovereign Wealth Funds, which was founded in 2008 under the supervision of the International Monetary Fund (IMF), developed the Santiago Principles, that are a collection of principles and practices on a voluntary basis, that should advise all the members of the IMF with a SWF on responsible asset management for the higher interest of a stable world economy (IWGSWF, 2008, pp.1-3).

2.4.1 Types of Funds

Even though there are many ways to define a SWF, they are always grouped by type of income or by objective of the fund. The origin of money inflows, from which the fund can invest in foreign reserves, can be divided into two categories (Rozanov, 2011, p.253). The first category consists of natural resource rich countries, gaining a surplus through export revenue. The second category of SWFs gains its money inflows from trade surpluses. Examples for such trade surplus countries are China, Singapore or Hongkong.

Rozanov (2008) created the liability-approach to categorize the four different main objectives of an SWF. These objectives can be divided into contingent liabilities, that represent stabilization and buffer funds in order to prevent DD and aim for a nominal return in foreign currencies, fixed liabilities, that have a limited timeframe and target value usually used for pure pension funds, mixed liabilities, that are allowed to regularly spend small amounts of their revenue and have no targeting value and open-ended liabilities, that have neither spending and time limitations, nor target value (Rozanov, 2008, p.40). Usually, SWFs are created for one of the named purposes. However the objectives are rather dynamic and can change according to the government's/society's needs (Rozanov, 2008, p.41).

2.4.2 Objectives and Functions

Some major functions of SWF can be already derived from the different types of the SWFs. However other functions are rather side effects of the main objectives or objectives that are pursued as a secondary matter. The first function represents the buffering effect an SWF can have on the domestic economy of a commodity-exporting country, which includes several aspects. On the one hand it can buffer the highly volatile commodity prices by isolating the domestic economy from the volatile revenue (IMF, 2008, p. 5; Amar, Lecourt and Kinon, 2017, p. 7; Mohaddes and Raissi, 2017, p.13), therefore reducing boom-bust-cycles (IMF, 2008, p.4; Amar, Lecourt and Kinon, 2017, p.19) and act as a stabilizer for the fiscal budget, as it balances periods of low commodity revenue due to lower commodity prices with periods of high commodity prices and thus higher revenue, even by withdrawing money⁶ to compensate fiscal budget deficits (IMF, 2008, p.11; Mohaddes and Raissi, 2017, p.13-14).

⁶ When allowed by the fiscal policy of the fund (spending-rule).

On the other hand, it prevents symptoms of DD and exchange rate volatility (Gomes, 2008, p.7; Corden, 2014, p.14; Amar, Lecourt and Kinon, 2017, pp.17-18) and can be a valid replacement for traditional reserves, as the SWF handles a commodity terms of trade shock smoother during past crises (Aizenman and Riera-Crichton, 2014, pp.11-12). Furthermore, commodity terms of trade volatility has a negative impact on the economic growth in countries that are dependent on natural resources. It is proven, that resource-dependent countries, who accumulate at least parts of their resource income in a SWF, react less sensitive to commodity terms of trade volatility, that prevents economic growth (Mohaddes and Raissi, 2017, p.14). This illustrates the crises prevention a state can install with a SWF.

Another function SWFs can hold, is the saving function through longtime asset management for future generations. Therefore, assets are allocated in a saving fund, to secure wealth also for future generations (e.g. as pensions) (IMF, 2008, p.5; Corden, 2014, p.14; Mohaddes and Raissi, 2017, p.13). Through the investment in assets in foreign economies, the SWF has the further positive effect of diversifying the economy and revenue. It transforms the non-renewable assets of their commodity revenue to financial assets (Gomes, 2008, p.7; Amar, Lecourt and Kinon, 2017, p.19), playing a significant role for future generations, when the resource boom will eventually decline (Corden, 2014, p.14).

Furthermore, the investment reasons can also be motivated by strategic involvement and the pursuit of economic development. Funds can be implemented for the financing of social or economic projects or in order to support governmental policies (Gomes, 2008, p.7; IMF, 2008, p.5). Additionally, the choice of investments can be driven by political relations (Knill, 2011, p.24) and to make strategic agreements on acquiring knowledge and technical expertise (Gomes, 2008, p.7).

As most of the effects of the Fund on the economy seem to be positive, such big asset accumulations also bear risks. The Santiago principles list different types of risks, that countries with an SWF may face (IWGSWF, 2008, p.23). The most considerable risk however is that the fund can, instead of supporting the budgeting, affect the budget negatively through insufficient management of the fund and missing spending rules or fiscal policies (IMF, 2008, p.11).

2.4.3 Norway's Government Pension Fund Global

In 1990 the Norwegian Government implemented a SWF as a response for the growing oil and gas revenue, with the first payment to the Fund's account in 1996, as this marks the first period since the founding, that accomplished a budget surplus (NBIM, 2024). The Fund was named 'Government Pension Fund – Global' whereafter all investments are placed outside of Norway, with the goal of supporting the Norwegian economy now and in the future through sustainable investment (NBIM, 2024). First the fund only accumulated the oil revenue, invested in foreign assets and gathered the returns of investments. However, in 2001 the Norwegian Parliament decided to launch a fiscal rule, so called 'handlingsregelen', that regulates the withdrawals from the fund to support the Norwegian government budget (Norwegian Ministry of Finance, 2022).

According to Rozanov's liability model (see section 2.4.1), the Norwegian GPFG was established as a fund with contingent liabilities to stabilize the Norwegian economy. When the fund gained more value overtime, the objectives were redefined, resulting into mixed liabilities. Even though the Norwegian government named it pension fund, it is not a conventional pension fund with a limited timeframe and strict pension plan.

The Fund is ruled by three instances in total: The Norges Bank which is managing the fund, the Ministry of Finance which sets the necessary policy framework for the management of the Fund and the Parliament which approves the legal structure that was designed by the Ministry (see Figure 8)(Skancke, 2003, p.327-329). For this purpose the Norges Bank established an own department, the 'Norges Bank Investment Management' (NBIM) that manages the assets since 1998 (Skancke, 2003, p.330).

The Norwegian Law determines, according to Act of June 22, 1990, No. 36, § 4, that all revenue from the Norwegian oil and gas industry are transferred to the GPFG. They make up half of the value of the fund, whereas the other half was earned through investments. It is important to mention, that the Fund only ever accumulates actual budget surpluses. In case of a budget deficit however, no money is added to the fund, but instead money from the fund is taken to cover the fiscal gap (NBIM, 2024). The 'handlingsregelen' specifies an estimation

of 3 percent⁷ for the yearly real return of the fund that can then be used and transferred to the Norwegian government, which should protect the real value of the fund (Norwegian Ministry of Finance, 2022). The amount of the withdrawal, however, is not fixed, meaning it can be up to the estimated 3 percent, and must be approved by Parliament (Norwegian Ministry of Finance, 2022). Even though 3 percent seem to be a small number, it equals around 20 percent of the Norwegian annual budget which shows the enormous dimension of the fund (NBIM, 2024). The withdrawals are placed counter-cyclically to support the economy during crises, as it was during the global financial crisis 2008/2009 and the Covid-19 pandemic in 2020/2021 (NBIM, 2023, p.5-6).

The Fund is invested in a deposit account in NOK and legally owned by the state of Norway (Skancke, 2003, p. 328). Investments are completely restricted to foreign investments, since investments in the own country can destabilize the economy and result in the worst-case scenario in a DD (see section 2.3). The investments are divided in equities, which values correspond to around 1,5 percent of all shares in global companies, fixed income, real estate and renewable energy infrastructure (NBIM, 2024). This confirms the broad diversification SWFs, especially accumulated through oil revenue, should have to avoid risk. A special focus lies on long-term, transparent and sustainable investments (NBIM, 2024). Since the implementation, the fund gained significant value (see Figure 4) and grew, according to a statistic from Statista (2024) to the largest SWF in the world (see Figure 9). The current value is dated to around 20.031 billion kroner (NBIM, 2025b).

In literature the Fund is usually mentioned by many authors as the best-case scenario of the implementation of a SWF. The fund is among the largest, when not the largest, asset accumulations in the world and additionally ruled by a democratic country which makes the Fund so exceptional. It works as an absorber for oil price volatility while it additionally provides extra budget for the government. Since the expenditures will rise due to the aging of the population, the capital outflows of the GPFG will increase accordingly (Skancke, 2003, p.325). This will avoid financial restrictions in other sectors, while allowing to hold the societal standard fixed (Skancke, 2003, p.325).

⁷ When implementing the spending rule, the ratio of expected real return was set to 4 percent of the fund value, however adjusted in 2017 to 3 percent, as the expected real returns were not as high as before anymore (NBIM, 2023, p. 5).

3 EMPIRICAL PART

As the previous chapter displayed, there is plenty of evidence for the advantages a SWF can hold and why it should be implemented in resource-rich countries. Norway followed this approach and established a SWF in 1990 in order to maximize their profits from the oil industry. After the first payment to the fund in 1996, the GPFG is continuously growing. This raises the question whether Norway profited from the positive benefits SWFs are supposed to have, especially the buffer effect for resource producing and exporting countries.

In order to answer the research objective, that was introduced in the beginning (see section 1), the author proposes four hypotheses, which are to be examined and answered in this following empirical part. The aim of this chapter is to analyze the research question based on descriptives of accessible data of the Norwegian economy, while answering the research questions.

H1: The volatility of NOK and real GDP is higher during oil price shocks before the implementation of the GPFG

H2: The average economic growth is larger after the implementation of the GPFG.

H3: The volatility of NOK and real GDP is smaller after the implementation of the GPFG.

H4: The GPFG buffers the negative effects of external shocks and crises on NOK and real GDP and stabilizes the Norwegian economy

3.1 Data

In order to answer the research question and test these hypotheses, two datasets were set up, that detect a possible buffer function. The first data set compares the variables oil price, GDP and the exchange rate. It should test the performance of the fund in the economy by comparing the volatility of these variables. The utilized time frame documented the variables on a quarterly basis between 1978 and 2024. This time frame was chosen, so that all variables are represented through the whole dataset. Data to the exchange rate and the oil price are

available even before 1978, however the quarterly real Norwegian GDP was only first published in the first quarter of 1978 and has since continued to today. Therefore, the time frame was adjusted accordingly. The data was acquired from official open data sources from Statistics Norway (SSB) and Norges Bank Investment Management (NBIM), as well as the data system of Macrobond (see Table 8). The SSB and NBIM are institutions run by the Norwegian government, wherefore the numbers can be seen as trustworthy and authentic.

Additionally, oil and gas are both important pillars in the Norwegian economy. However, in the analysis the oil price will be used, as the oil price is more object to research. Furthermore, looking at historic data of oil and gas imports, the oil exports outweigh the gas exports earlier in the timeline of Norway's oil and gas industry, making the gas exports less relevant at the beginning of the set time frame (see Figure 1). Only recently, gas exports have become more relevant for Norway, which is not sufficient to justify the usage of gas prices in this analysis. The nominal oil price, as the oil price is observed over a long period and therefore should depict the long-term effect of oil prices on GDP and NOK without the disturbance of inflation. The oil benchmark that is chosen is the Brent crude oil price because it is used for the oil produced on the European Nord shelf and represents the oil prices in Europe, therefore most relevant for Norway as a European country. Despite reflecting the European oil market, the Brent crude oil price is denominated in United States Dollar as it is traded globally in this currency.

Exchange rates are an important factor, when it comes to the economy of a country (see section 2.1). The USD is chosen as a base currency, to match the oil prices, which are depicted in USD as well. The exchange rate is depicted in USD/NOK. For simplicity reasons the nominal exchange rate is chosen, as it is available in the Macrobond database.

Furthermore the real GDP growth rate is included in the analysis. It measures the inflation-adjusted change in Norway's total economic output and therefore acts as an indicator of macroeconomic stability. The real GDP per capita growth rate further depicts demographic changes, however for simplicity reasons, since it does not include a comparison to other countries and because the focus of this analysis is on macroeconomic dynamics, this variable will not be considered.

To better compare the variables and stabilize the variance, some of the variables have been used in log form. This counts especially for the NOK exchange rate and the Brent crude oil price, as both time series are affected by high volatility and exponential growth. Therefore, in econometric analyzes such variables are often transformed with the natural logarithm (log) to smoothen distortion by outliers (Lütkepohl and Xu, 2009, p.1). The GDP growth rate remains in its original form, as it already expresses a percentual rate. The absolute values of the computed log variables are added to the data frame as well.

In order to compare the different variables before and after the implementation of the fund, the data must be divided into subperiods. The first sub period marks the time before the implementation of the GPFG, from the first quarter of 1978 until the last quarter in 1995. The second period begins subsequently with the first payment that was transferred to the fund, thus the time where the SWF can possibly show its buffer mechanism, which is in the first quarter of 1996 and ends in the last quarter of 2024. The subperiods are added to the data frame as a categorizing variable.

The second data set measures the performance and stability of Norway's economy, by looking at the fund's withdrawals in comparison to the fund's value, the mainland GDP and the expenditure of the central government. The data is documented on a yearly basis, however, the availability of the variables differs. The volume of the fund is just documented from 1998, even though the first transfer to the fund was in 1996. The management reporting system to the public in the early stages of the fund was not open to the public and therefore no further (public) information on the fund's value before 1998 exists. Additionally, numbers of the funds structure, oil revenue inflows, real return and the impact of the NOK value, are provided from 1998 onwards. The withdrawals are documented from 2001 onwards, as this marks the implementation of the spending rule and since then relative sums can be withdrawn from the fund to support the budget (see section 2.4.3). The mainland GDP and the expenditure of the central government exist even before 1998, however as the main objective of this data set is, to compare the withdrawals with the economy, the data is only needed from 2001 onwards. Therefore, the length of the time-series is adjusted to the withdrawals from 2001 until 2024. Here the mainland GDP at market price is chosen in order to compare how big the influence of the fund is on the non-oil economic performance. The central government should depict how strong the support of the fund is on the government spending. The fund's volume is accessed from the NBIM itself, whereas GDP and expenditure are

downloaded from Statistics Norway (see Table 8). The fund withdrawals are accessed via Macrobond (see Table 8).

3.2 Methodology

For analysis and graphical depiction R Studio ‘Version 2024.12.1+563’ was used, as it is suitable for descriptive analysis and is an open-source tool. Packages ‘tidyverse’ including ‘ggplot2’, ‘tidyr’ and ‘dplyr’ were used in order to compute the needed output. Microsoft Excel was used to visualize further outputs. As previously explained, the analysis of the buffer function is divided into two parts. This is mainly because the two parts focus on different aspects of the buffer function. Additionally, the time spans of the two objectives analyzed differ in size, wherefore it is more sufficient to separate the data in two.

The first part focuses on how the fund buffers the effects of shocks and crises in the Norwegian exchange rate and the real GDP. Furthermore, the influence of oil shocks on the NOK/USD exchange rate and the real GDP growth rate is to be analyzed. In order to examine the buffer function of the Norwegian SWF, the NOK exchange rate and the real GDP serve as indicators for price changes due to the oil price. To start the descriptive analysis, oil shocks are identified in the Brent oil price series and compared to the performance of the exchange rate and real GDP during oil price shocks to periods of a characterized by a stable oil price. An oil price shock in this thesis is assumed to be below the first decile and above the ninth decile of all data points of the series. According to this definition, the data points are divided into shock and non-shock. Therefore, all data points falling into that definition are marked with ‘TRUE’, or else with ‘FALSE’. Following, with the pre GPFG subperiod and the post GPFG subperiod, the mean of the absolute values of the log exchange rate and the GDP rate can be compared in four categories: before the fund during an oil shock, with the fund during an oil shock, before the fund without an oil shock and with the fund without an oil shock. The absolute mean return is an alternative measurement tool for volatility (Cotter, 2007, p.4-9). Additionally, also the standard deviation (SD), as the usual unit for volatility for financial data (Poon & Granger, 2003, p.480), is derived for the different categories. In the next step the overall mean of the real GDP growth rate in the first subperiod and the second subperiod are compared. Further analysis focuses on the comparison of volatility within exchange rate and real GDP in the two subperiods. Therefore, the SD of the first period is compared to the SD of the second period. As financial data is usually highly volatile, it is however difficult to assume, that a constant SD is informative for the whole dataframe or the two subperiods

(Zivot, 2021). It can be helpful to look at multiple SDs from this data frame, calculated with only parts of the data, in order to depict the trend in volatility and smoothen smaller shocks, while highlighting severe shocks, influencing the examined variables. Therefore, a rolling standard deviation is computed over the whole timeframe, with a rolling width of twenty rows, meaning five years⁸. The business cycle in Norway, compared to other European countries, is rather asymmetric, thus can be longer or shorter than usual (Bjørnland, 2004, p.33). Therefore the length depicts the median of the normal business cycle of two to eight years in Norway (Bjørnland, Brubakk and Jore, 2005, p.93). Plots of each rolling variable support the interpretation of the output. Because this analysis is however limited to descriptive data only, there will be no statistical significance of the results, rather statistic relevance or indication. The descriptive analysis however can give a first tendency of the answer to a research question, in order to shape the further inductive statistics, even though there is no causality.

The second part of the analysis focuses on the Fund itself and the withdrawals that are added to the government budget to ensure the government expenditure. The fund structure is being analyzed in order to evaluate the influence and dependency on the oil industry compared to the GPFG. Additionally, the outflows from the fund to the government are compared to the fund volume itself, to explain the ‘handlingsregelen’ in more detail, the mainland GDP of Norway, in order to demonstrate the impact of the withdrawals on the non-oil economy, and the central government expenditure, as to see how significant the withdrawals are for the Norwegian budget. This approach is based on the report about withdrawals from the GPFG published by the NBIM in 2023 (NBIM, 2023, p.6). A list with the used variables in the R-script and the tables can be found in Table 7.

3.3 Analysis

At the start of this analysis reactions of the exchange rate and the GDP rate during shock and non-shock periods will be investigated. Therefore, the means of the absolute values of each variable are compared before the implementation of the GPFG and after. For this the data is divided into a pre GPFG period and a post GPFG period, as well as oil shock and non-oil shock, printed in Table 1. Furthermore, for comparison of the groups, the numbers of

⁸ After additionally testing the rolling width of three and seven years, the five-year window depicted the main shock events that influenced the exchange rate and the real GDP the best, whereas the curve in the three-year window peaked too often and the shocks in the seven-year window were not identifiable (see Figure 10-Figure 13).

observations are given by the variable ‘n’. It becomes evident that groups differ in size by up to 11 years, so 40 periods, while the ‘pre_GPFG’ group misses another argument, due to the transformation of the base variables to growth/log rates. Table 1 shows all the values computed and the change in absolute numbers and percentage.

Firstly, within both subperiods, the mean movement increases in both exchange rate and GDP from non-shock to shock periods (see Table 1). This shows that there is increased movement during shock periods, compared to non-shock periods. That gives the implication, that during oil price shocks, the economy is also affected through currency and GDP. Comparing the subperiods to one another, one would assume the buffer function of the GPFG to minimize the movement during oil price shocks, thus the movement during shocks decreases in the second period. The results however show that there is an increase in movement during shocks in the second period compared to the first period. While the movement of the exchange rate increased roughly 21.82% in the first period from non-shock to shock period, in the second period it increased about 34.46% during shock periods. The results of the GDP rate are even higher, as the difference between shock and non-shock in the first period was at 19.78%, whereas in the second period the difference is at 50.39%. This goes against the assumption of higher movement during oil shocks in the first period, compared to the second period. Noticeable however is, that the value during non-crises has not risen in both exchange rate and GDP. Meaning that during non-shock periods, the movement is lower in the second period compared to the first.

Subperiod	Shocks	n	Mean_fx_abs	Mean_rGDP_abs
pre_GPFG	TRUE	11	0.04988794	0.010347287
	FALSE	60	0.04095208	0.008638372
	NA	1	NA	NA
post_GPFG	TRUE	27	0.05394427	0.012271864
	FALSE	89	0.04011796	0.008159790
pre_fx_diff = 0.008936, post_fx_diff = 0.013826 pre_fx_ratio = 1.218203, post_fx_ratio = 1.344641 pre_rGDP_diff = 0.001709, post_rGDP_diff = 0.004112 pre_rGDP_ratio = 1.197828, post_rGDP_ratio = 1.503944 shock_ratio_1 = 0.154930, shock_ratio_2 = 0.232759				

Table 1: Average absolute growth rate of USD/NOK exchange rate and real GDP growth rate, before 1996 and after, during oil shocks and non-oil shocks, differences and ratios of the variables and groups
Source: own illustration based on calculations

Comparing now the results of the SD in the same categories, printed in Table 2, it shows a similar but more drastic outcome to the absolute means. The volatility is higher in all shock periods compared to the non-shock periods in the same subperiod. In the first subperiod, the

SD for the exchange rate increases 11.57%, whereas in the second it increases 52.43%. For the real GDP the percentual difference in the first period is at around 12.77%, while the second depicts an increase of more than 240%. Also, here the volatility during non-shock periods, decreased for both variables in the post period. What can be derived from the results is, that there is an increased volatility during oil shock period in both exchange rate and real GDP growth rate. However, the volatility during shock periods is on average higher in the post period, than in the pre period. Moreover, the volatility during non-shock periods decreases from pre to post period. Therefore hypothesis 1 can only be partly accepted, as a tendency of increased volatility during shock periods in both periods is visible, but the volatility is higher after implementing the fund. Therefore, the alternative hypothesis H1.1 can be presented and accepted:

H1.1: The volatility during non-shock periods of the oil price decreases after the implementation of the fund for both exchange rate and real GDP growth rate.

Subperiod	Shocks	n	SD_fx	SD_rGDP
pre_GPFG	TRUE	11	0.06038115	0.011879987
	FALSE	60	0.05411900	0.010534967
	NA	1	NA	NA
post_GPFG	TRUE	27	0.07683406	0.019360562
	FALSE	89	0.05040584	0.008065044
pre_fx_diffsd = 0.006262, post_fx_diffsd = 0.026428				
pre_fx_ratiosd = 1.115711, post_fx_ratiosd = 1.524309				
pre_rGDP_diffsd = 0.001345, post_rGDP_diffsd = 0.011296				
pre_rGDP_ratiosd = 1.127672, post_rGDP_ratiosd = 2.400553				
shock_ratio_1 = 0.154930, shock_ratio_2 = 0.232759				

Table 2: SD of USD/NOK exchange rate and real GDP growth rate, before 1996 and after, during oil shocks and non-oil shocks, differences and ratios of the variables and groups
Source: own illustration based on calculations

Even though there seems to be an increased movement in the second subperiod for both absolute mean and SD, it is helpful to check for the overall value of the real GDP growth, before and after 1996. Comparing the mean of the rGDP_rate, with negative and positive values, in both periods, as seen in Table 3, the growth increased overall from the first period to the second by around 13.37%. This shows, an overall economic growth, wherefore hypothesis 2 can be accepted.

However, this result does not give an indication on how stable this growth is or whether there is indication of the GPFG buffer function. The stability of the economic growth can be examined by looking at the SD of both variables in both periods. If the overall SD decreases from the first to the second period, the volatility of economic growth is therefore more stable. It is assumed, that the volatility is lower in both variables after the implementation of the fund, as it should act as a buffer to shocks and crises (see H3, H4).

Subperiod	rGDP_mean
pre_GPFG	0.005380630
post_GPFG	0.006100253
rGDP_mean_diff = 0.000720, rGDP_mean_ratio = 1.133743	

*Table 3: Average real GDP growth rate, before 1996 and after
Source: own illustration based on calculations*

Therefore, the SD is computed for the exchange rate and the real GDP growth rate, for each subperiod. For the exchange rate in the first subperiod, before the implementation of the fund, the SD shows a value of about 0.0547, compared to the post value of about 0.0574, which depicts an increase of 4.88%. The SD for the exchange rate has slightly increased in the second period, opposed to the expectations of a lower volatility.

The SD of the real GDP is about 0.0107 in the pre period and about 0.0117 in the post period, which corresponds to an increase of about 9.20%. This means, that also the GDP SD increased from the first to the second period. Meaning also here, the volatility increased in the second period, against the assumption. Hypothesis 3 therefore must be declined.

Subperiod	Fx_SD	rGDP_SD
pre_GPFG	0.05467676	0.01069216
post_GPFG	0.05734733	0.01167605
Fx_SD_diff = 0.002671, Fx_SD_ratio = 1.048843, rGDP_SD_diff =, 0.000984, rGDP_SD_ratio = 1.092020		

*Table 4: SD of log USD/NOK exchange rate and real GDP growth rate before and after the implementation of the GPFG
Source: own illustration based on calculations*

To trace down, why the overall SD increased instead of decreased, the SD is analyzed in more detail by computing a rolling SD over the whole dataset. Figure 2 shows the rolling SD of the real GDP growth rate, with a five-year window for each SD calculated. The graph starts in the first quarter of 1983, as that marks the first data point, where the SD could be calculate based on past data of five years. The output can be plotted in a graph, that shows, in which periods the volatility has been higher than in others.

Looking at the rolling SD of rGDP_rate, it can be observed, that the volatility has been higher in the first subperiod, from 1983 until 1996. From 1996 until 2020, the overall volatility decreases, despite minor peaks around 2000 and 2010. In 2020 however, the volatility rises drastically to the highest value that the graph depicts.

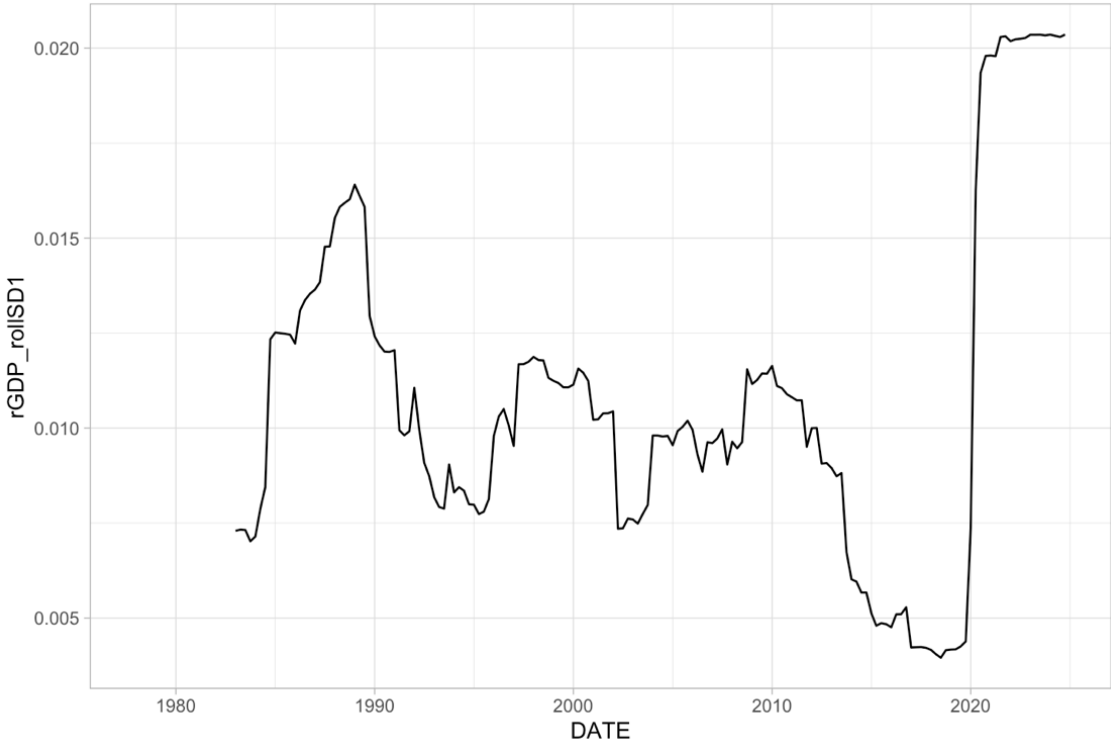


Figure 2: Rolling Standard Deviation of the real GDP growth rate with a rolling window of five years (20 periods)
 Source: own illustration based on calculations

Even though the overall volatility is higher in the post period, the impact seems to come from one major event in 2020, as the volatility appears to be much smoother from 1996 until 2020. To prove this observation an alternative subperiod is formed, from the first quarter in 1996 until the last quarter in 2019. The overall SD in this subperiod, with a value of 0.008952, is smaller than the SD in the pre period, as one can see in Table 5.

Subperiod	Fx_SD	rGDP_SD
pre_GPFG	0.05467676	0.01069216
post_GPFG_alt	0.05435519	0.008951916
diff_fx_SD2 = 0.000322, ratio_fx_SD2 = 0.994119		
diff_rGDP_SD2 = 0.001740, ratio_rGDP_SD2= 0.837241		

Table 5: SD log USD/NOK exchange rate real GDP growth rate in pre period and alternative post period from implementation of the fund until 2020
 Source: own illustration based on calculations

The rolling SD of fx_rate is computed in the same way, with a rolling window of five years. Figure 3 shows the output in a plotted graph, the time frame ranging from 1983 until 2024. Similar to the graph of the SD of $rGDP_rate$, it shows certain peaks in the volatility, that explain the increased value. In the early 1990 years until 1996 the curve peaks to a high value. Around 1996 the volatility decreases to a minimum in 2000, and rises to a moderate level compared to the overall curve. Right before 2008 it decreases again, before it rises in the third quarter of 2008, staying high until the last quarter in 2013. In the last period the graph reaches a local minimum again, before it rises again to a higher level until the end of 2024. Applying the same alternative post subperiod to the exchange rate, the volatility decreases less than 1% in the second period. Therefore, one can assume, that it roughly does not change at all, even with the cutout of the shock from 2020 on.

Comparing the two figures to each other, shows that both variables seem to be affected by shocks differently. While the GDP growth in the second period was impacted mainly by a shock around 2020, the exchange rate was hit by a shock in 2020, but also by severe shocks around 1996, 2005 and 2010. Furthermore, the overall volatility of the exchange rate is higher than the one in the real GDP growth rate. The overall GDP growth rate is smoother than the exchange rate.

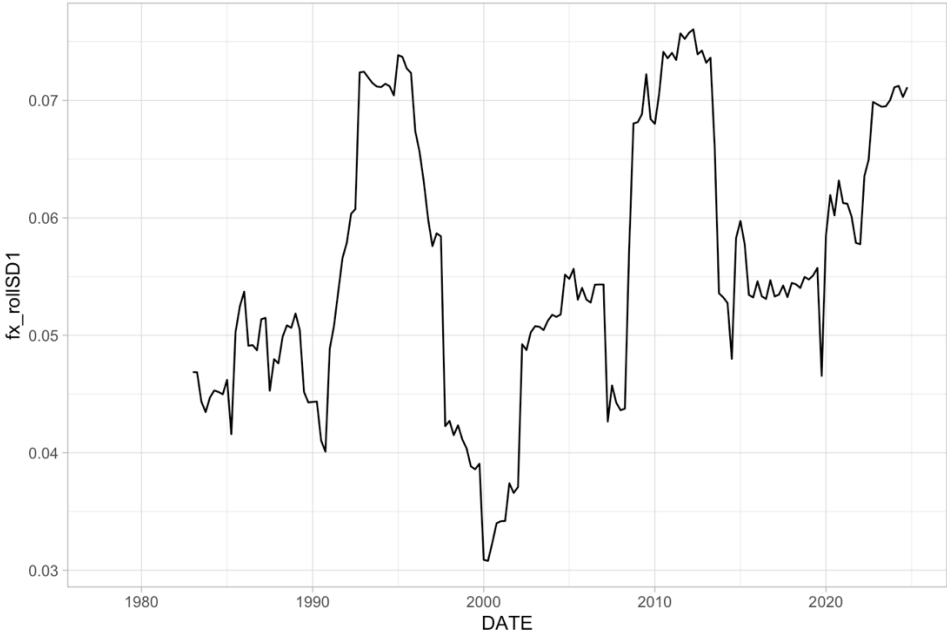


Figure 3: Rolling Standard Deviation of log USD/NOK exchange rate with a rolling window of five years (20 periods)
 Source: own illustration based on calculations

Evaluating the results to answer the first part of hypothesis 4, one can see, that despite one major crisis around 2020, the volatility of the real GDP growth rate decreased. Assuming to cut out the shock in 2020 for both variables, it can be seen, that in fact the real GDP growth rate is smoother and less volatile in the second period. However, the exchange rate remains equally volatile in the post period, even with the cutout. Multiple cutouts of severe crises had to be computed, to smoothen the SD of the exchange rate, though the data would be relatively diminished through the process. It cannot be said with significance, that the volatility for the GDP decreased through the buffer effect of the GPF, but the decreasing values appear to be from the implementation of the fund. Therefore, the first part of hypothesis 4 cannot be accepted. The alternative hypothesis can be accepted:

H4.1: The volatility of the real GDP growth rate decreases after the implementation of the Fund until 2020.

3.3.1 Fund Structure and Withdrawals

To supplement the initial analysis, it is helpful to look at the fund structure and the value the Norwegian government decides to withdraw every year from the fund's returns. This can give insight on how the revenue accumulation in a fund can help to generate additional budget and how this surplus can then be used on the governments' budget.

Figure 4 shows the market value structure of the fund, divided into inflows from the petroleum industry, the value gained from investments and the impact of the NOK. Observing the long-term development of the fund's value, it is obvious that the fund grew immensely. Despite the change in value from 2017 to 2018 the fund managed to gain value in every other year compared to the previous period. However, looking at the value creation within the fund it becomes clear that the fund does not mainly consist of inflows from the oil revenue anymore. While the inflows depicted the predominant part in the value in the beginning, now most of the value creation of the fund can be traced back to the actual investments, reaching almost double the value of the inflows by 2024. This shows the significance of the fund for the Norwegian economy today and in the future, as the oil revenue was not just used from the Norwegian government but instead was accumulated in a fund to enlarge the value through investments. Thanks to the diversification of GPF portfolio, the income is less dependent on the cyclical effects of the oil revenue and the resulting effect from the NOK. The most meaningful take-away from this graph is, that the Norwegian Government or NBIM achieved to create additional value to the oil revenue, which makes the fund

independent from the inflows of the oil industry, especially when oil and gas revenue will decline.

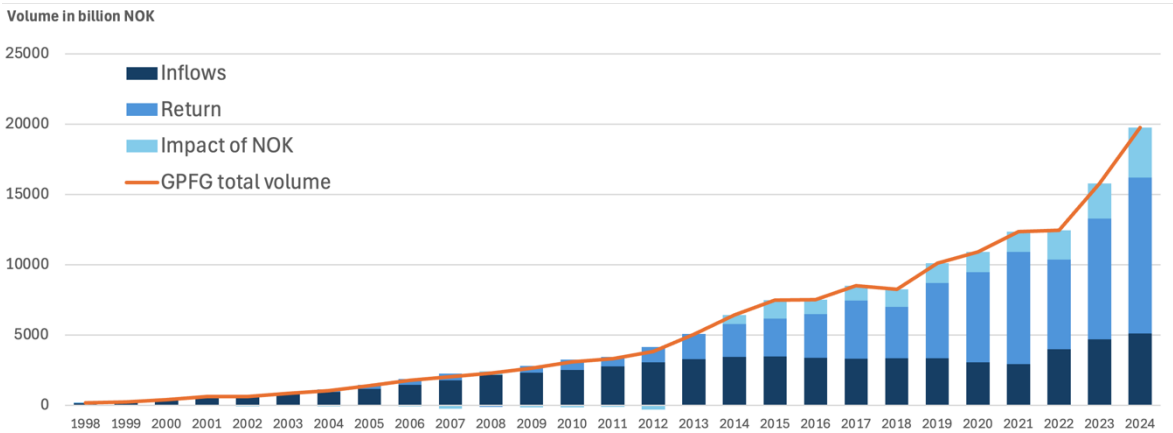


Figure 4: Fund structured in value obtained from petroleum revenue, investments and currency impact
 Source: (NBIM, 2025b), own illustration

Figure 5 shows the withdrawals from the GPFG, that balance the budget deficit, relative to the fiscal expenditure, the GPFG volume and the mainland GDP. The deficit depicted is non-oil related, while the value of the GPFG represents the number at the beginning of the year. As previously said, the graph documentation started in 2001 when the spending rule was established. When looking at the graph, at the beginning of the time frame, from 2002 and 2004, the withdrawal-fund-volume ratio is relatively high, about 9%, even though the spending rule was then at a level of 4 percent (see section 2.4.3).

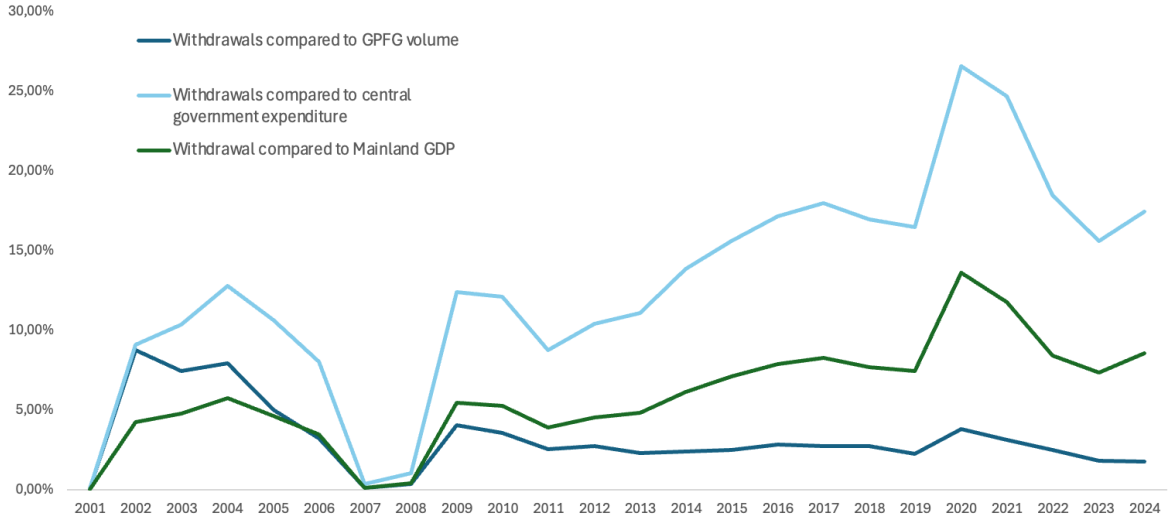


Figure 5: Withdrawals from GPFG in relation to fiscal expenditure, GPFG volume and Mainland GDP
 Source: (NBIM, 2023, p.6), own illustration

Other than that, the spending rule has been respected ever since. Looking at the graph’s curve, only in 2009 and in 2020/2021, the Parliament decided to withdraw little above the amount of 4 percent, or later 3 percent from the Fund, as one can see in Table 6. Looking at the previous analysis, those are the same shock events that impacted the real GDP growth rate and exchange rate. When focusing on the fiscal expenditure ratio and mainland GDP in comparison, they show how crucial the support of the fund-outflows is for the Norwegian economy.

	2002	2003	2004	2005	2009	2020	2021
Withdrawals of GPFG in %	8.77	7.43	7.94	5.05	4.06	3.82	3.16

*Table 6: Percent of Withdrawals compared to total GPFG value, above the ‘handlingsregelen’ for that period, since inception
Source: own illustration based on calculations*

As the main part of hypothesis 4 had to be rejected, the second part focuses on stability of the Norwegian economy. By excluding extreme shock periods in the evaluation of the real GDP, it could be derived, that the economy measured in GDP growth was in fact stabilized after the implementation of the fund. However, the effect could not be traced back directly to the GPFG. When now looking at the graphs in the second part of the analysis, these show, that during shock periods, the fund can balance the budget and secures the expenditure of Norway. The fund acts as a security net in terms of crises. Furthermore, the structure of the fund shows, that this security can also be provided in the future without the dependency on the highly volatile oil industry. The value creation through foreign investments has surpassed the inflows from the oil revenue. Through all this, one can argue the GPFG does in fact secure the expenditures of the Norwegian country and therefore provides some stability. As economic stability is not just measured through the budget of a country, the second part of the hypothesis cannot be accepted either. Therefore, another alternative hypothesis is installed and accepted:

H4.2: The GPFG secures the government expenditures and balances the budget through shock periods.

4 DISCUSSION

In the first step of the analysis an increased movement of the exchange rate and GDP during oil-shock periods could be detected, compared to non-shock periods. This leads to the assumption, that the Norwegian economy is heavily linked to the oil price movements. In general, the research showed that resource rich countries tend to be affected by volatile world commodity prices (see section 2.2). However, not all the findings and assumptions can be applied to the Norwegian economy.

The Norwegian economist Hilde C. Bjørnland examined the relationship between several economic variables in the Norwegian economy in 2004, including the real exchange rate, the real GDP and the real oil price. She found out, that oil price shocks explain about 5% of the depreciation of the exchange rate and about 5-10% in GDP (Bjørnland, 2004, p.36). Meaning in the short run, both variables were affected from the oil price, whereas in the long run, both exchange rate and GDP are not significantly affected by oil price shocks (Bjørnland, 2004, p.36). Having chosen a VAR model and the real values of the variables, make Bjørnlands results more relevant, than the outcomes in this analysis. Nevertheless, they confirm the findings in the first analysis, that oil price shocks are affecting the exchange rate and the GDP, even though just in the short run. However Akram and Mumtaz later examined the relation of exchange rate and the oil price and came to the conclusion that the relation was just developing in the 1990s and is due to its time-varying nature influential during oil price drops such as in 2008 and 2014 (Akram and Mumtaz, 2019, p.423). This can explain why the volatility during oil price shocks after the implementation of the fund was higher than before. It also aligns with the observation, that the volatility in non-shock periods decrease in the second period.

The connection of oil as a commodity and currency additionally leads to the question, whether the NOK is actually a commodity currency. Bjørnland and Hungnes give indication that the NOK is in fact a commodity currency, as it moves symmetrical, to a certain extent with the oil price movements (Bjørnland and Hungnes, 2005, p.19). This aligns with the definition of commodity currencies by Clements and Fry (Clements and Fry, 2013, p.126) and the findings of Bjørnland (2004) as well as Akram and Mumtaz (2019) above. However it must be noted, that this movement is only temporary, as the exchange rate is not permanently affected by oil price shocks (Bjørnland, 2004, p.36; Bjørnland and Hungnes, 2005, p.19).

Secondly, based on the results from Table 3, hypothesis 2 was accepted, as it detected an average growth of the economy from the first to the second period. Looking at the rolling SD for real GDP growth until 2020, the volatility slope decreases. This aligns with the findings of Ramey and Ramey, who suggest that GDP growth rates are highly influenced by the year-to-year volatility itself (Ramey and Ramey, 1995, p.1140). Thus, the decreasing volatility in GDP growth in Norway would explain the overall economic growth (see Figure 2). Furthermore the effect of crises is less intense on countries with a well-developed financial system and a high development stage (van der Ploeg and Poelhekke, 2009, p.748). This can be applied to the Norwegian economy as well and explain why, despite major crises, the overall GDP grew in the second period.

Norway's economic success is out of question, when looking at the overall Norwegian wealth. Bjørnland et al. (2019) argue that despite the assumptions of the DD, a well-developed oil industry can also increase the economic growth, especially for countries who have an SWF (Bjørnland, Thorsrud and Torvik, 2019, p.29). This accounts especially for Norway, which managed to grow economically over a long period, through its oil sector, despite the risks of the DD.

Whether the economic growth can be dated back to the implementation of the GPFG cannot be answered with full certainty. Connecting the SWF as a financial and fiscal tool to the argument of van der Ploeg and Poelhekke above, the SWF can contribute to the overall economic growth. Grigoli et al. found out, that countries with a floating exchange rate and a buffer with foreign reserves, as with SWFs this is the case, are less effected by economic shocks than countries with fixed exchange regimes (Grigoli, Herman and Swiston, 2019, p.491). Meaning, that only in combination with a floating exchange rate system, SWF are helpful to prevent crises. Norway have run a managed floating system for almost a decade before implementing a freely floating system in 2001 (Alstadheim, 2016, pp.9-10). Therefore, it could be coincidental, that the economy grew during the time the GPFG exists. However, looking at the results of the conducted research, Norway's economic growth dates back to an interaction between different macroeconomic factors and overall financial stability. For example floating exchange regimes are better in absorbing shocks, than fixed regimes, the requirement is a stable financial and monetary system (Anderson, Veyrune and Stone, 2008, p. 42). The SWF then contributes to the financial stability.

Thirdly, the assumption that the overall volatility of the exchange rate and GDP decreases after the implementation of the fund was declined. The findings suggested that the volatility in both variables increased from 1996 onwards. However, when looking at the rolling SD of both variables, there was a hint, that the second time frame contained more severe crises and shocks on average, than the pre period. Furthermore, concerning oil price shocks, the possibility of a period being categorized as a shock differ in the two subperiods. Looking at the shock definition in the beginning, 15% of the periods in the first subgroup are categorized as a shock period, however in the second group around 23% of the periods are categorized as shock periods. This supports the argument, that both subperiods are difficult to compare. It seems as if the oil price was more volatile in the second period.

However also other crises might contribute to this outcome. Bjørnland came to the conclusion, that Norway was more sensitive to crises and shocks in general, compared to other countries in Europe and adds that often exchange rates absorb shocks in these countries before they can affect the real economy (Bjørnland, 2004, p.33). Another side notice was that exchange rate and real GDP were also transmitting shocks in a different intensity. Whereas the exchange rate was more sensitive to shocks in general, the real GDP was mainly affected by one shock in 2020. This can be connected to the findings of Bjørnland, as she proves that exchange rate and GDP are affected by different types of crises. She states that GDP shocks are explained by 50% labour supply shocks, 20-30% nominal shocks and 20% productivity shocks, while the exchange rate movements consist of 70% demand shocks, also 20% productivity shocks and only 10% labor supply and nominal shocks (Bjørnland, 2004, pp.34). Therefore, the rolling SD curves shown in the analysis are valid, as they mostly depict different kinds of shocks.

Looking at the major crises that occurred in the second time frame, some events caused increasing movement in both variables. One major event that effected the Norwegian economy, was the world financial crisis in 2008/2009 (Backer, 2009, pp.478-479). This aligns with the rolling SD graphs, as they show minor effects in real GDP, however large effects in the exchange rate. The second event that caused high volatility especially in the real GDP was the Covid-19 pandemic in March 2020. The annual reports of Norges Bank from 2020 until 2022 give a more detailed insight on the economy and the exchange rate. In 2020 the global pandemic let the Norwegian economy to drop drastically and caused high

unemployment as well as financial market volatility (Norges Bank, 2021, p.56). Also the NOK depreciated in spring 2020 due to an uncertainty in the NOK market (Norges Bank, 2021, p.27). The consequences of the pandemic carried on in 2021: the mainland GDP recovered by mid of the year, however due to restriction decreased again at the end (Norges Bank, 2022, p.44). The Krone was less volatile than the previous year, only appreciated due to rising oil prices and depreciated when uncertainty grew due to unexpected turns of the pandemic (Norges Bank, 2022, p.43).

2022 was still affected by Covid at the beginning of the year, but was quickly overshadowed by the Russian invasion of Ukraine, which caused the energy prices to rise sharply (Norges Bank, 2023, p.20-21). Further the year was marked by high inflation rates and market uncertainty, which were depicted in a highly volatile exchange rate (Norges Bank, 2023, p.47). The economy itself could recover from the Covid pandemic and performed better than expected (Norges Bank, 2023, p.47). Due to the restrictions for society and economy, that were set and released multiple times from 2020 until 2022, the GDP, was highly volatile, which is shown also in Figure 2. The volatility of the exchange rate was less affected by the pandemic. However, in 2022 due to high inflation rates and market uncertainty, the exchange rate became highly volatile, as seen in Figure 3, while the GDP could slowly recover from the Covid pandemic (Norges Bank, 2023, p. 47).

These three events can explain the mainly observed volatility in GDP and exchange rate. While the exchange rate is a lot more volatile, the GDP was mainly affected by the Covid pandemic. The crisis depicts one of the deepest recessions ever recorded (Ilzetzki, Reinhart and Rogoff, 2021, p.30), that was dominated by market uncertainties. As it cannot be seen as a usual crisis, due to its serious consequences, and cannot be compared to any other crises, it is justifiable to exclude the data from 2020 on, to evaluate the performance of the real GDP. Therefore, one can say, that the real GDP overall is less volatile in the second period. It supports the assumption in H4.1.

Lastly, as discussed previously, the GDP growth volatility decreased after the implementation of the fund until 2020. Whether this result was mainly influenced by the buffer function, could not be proven. Despite the existing research on SWFs in general (see section 2.4.2), many papers focus their research on developing countries or the majority of examined SWFs are governed by developing countries (Koh, 2016; Amar, Lecourt and Kinon, 2017;

Mohaddes and Raissi, 2017; Hasse, Lecourt and Siagh, 2024). As Norway's SWF is quite unique, a lot of results derived in the different papers cannot be applied to the Norwegian economy and SWF. There is not much research on the benefits of the Norwegian fund in particular. However, some information can be derived from annual reports of the central bank and a few research papers on dynamics in Norwegian economy.

Thereafter, the GPFG helped buffer the world financial crisis that affected the Norwegian economy in 2008/2009, as a higher percentage was withdrawn from the fund and revenue were further used to finance an economic stimulus package to support the domestic economy (Backer, 2009, pp.478-479). This partly aligns with Figure 5 and Table 6, as it shows an increasing percentage of withdrawals during this period. Also in 2020, when the Covid-19 pandemic hit the global economy, the Norwegian government decided to withdraw more than the usual amount from the fund in order to cover the additional costs, caused by the crisis (Norges Bank, 2021, p.57). These specific examples support the assumption in H4.2.

When addressing the topic of economic stability in a country with a large resource exporting sector, one quickly comes across the term DD, as its signals threaten the economic stability and development of a country. Larsen advocated already in 2006 that despite some signals of the DD, as the Norwegian economy was restructured to make the oil industry possible, it did not affect Norway, which is partly due to constant production even in the beginning, an only moderate labor movement to the oil sector and not an entire reliance on the oil revenue (Larsen, 2006, p.617). He states that Norway escaped the resource curse and disease until then, mainly because of macroeconomic policy, including active income coordination, that prevents the wages in the manufacturing business from decreasing, compared to the oil industry, as well as investing the oil revenue abroad, as the Fund does (Larsen, 2006, p. 636). Furthermore he describes the fund as a reason for preventing the resource curse, but sees its role rather as a political tool, that gained much popularity among Norwegian citizens, as it transparently shows the Norwegians wealth accumulation and raises the interest in the public of how to use the returns of the fund (Larsen, 2006, p.631-632). Therefore, the topic and purpose of the fund is highly discussed in politics and politicians like to promote the further development of the fund in favor of the citizens. Later Bjørnland et al. confirm as well that Norway has escaped the DD. They argue that due to the development of the oil service sector, there has been a shift in the economy, causing the productivity, against the assumptions of the DD, in the domestic economy to increase (Bjørnland and Thorsrud, 2014, p.19;

Bjørnland, Thorsrud and Torvik, 2019, pp.27-28). It is added, that this is especially relevant for countries with SWF, that have to care less for the spending effects of the resource revenue, as they are allocated in funds, but for the productivity level in the economy (Bjørnland, Thorsrud and Torvik, 2019, p.5). This supports the findings from above, that the SWF is mere a support in the Norwegian economy, but the economic stability is not fully reliant on the fund. Therefore, it seems as Norway has escaped the resource curse, according to the definition of Sachs and Warner (Sachs and Warner, 1995, p.4), as the high resource intensity in the Norwegian economy is not connected to weak economic growth or stagnation, shown by the results above.

The results and the available literature provide multiple insights to the Norwegian economy. Connecting the outcome to the research question, introduced in the beginning, the results and discussion show, that the oil price fluctuations do affect the exchange rate and the GDP, however only in the short run. Despite the oil revenue that is dependent on the oil prices, the Norwegian economy is not much affected by the oil price fluctuations in the long term. The role of Norway's Sovereign wealth fund however is more complex. The results in the analysis show that, after the implementation of the fund the exchange rate showed no decreased volatility. Therefore, the buffer function is not applicable to the exchange rate. Looking at the real GDP, until 2020, it was less volatile compared to the period before the fund existed. This gave an indication of a buffer function. However, considering the literature available on economic stability and SWFs, applicable to the Norwegian economy, it is indicated that the overall development of Norway's economy, including the SWF, is responsible for continuous economic growth. This includes macroeconomic policy, such as income coordination (Larsen, 2006, p.636), or the stability arising from the freely floating exchange regime (Grigoli, Herman and Swiston, 2019, p.491), Norway has since the early 2000s. Meaning, the sole buffer effect of the GPFG cannot be insulated from other key elements, impacting the economy, as they only function when interacting with each other. Concluding, the SWF has an impact on the increased stability in the Norwegian economy, but only in combination with other macroeconomic mechanisms, that support the stability as well.

5 LIMITATIONS OF THIS RESEARCH

Due to the scope of the thesis, the empirical framework is subject to certain limitations, that will be listed below. Many papers use the descriptive analysis of different factors before the variables are examined in a model together, to get a first tendency of the movements of the variable especially also visually. By the means of plots, the graph can be explained better and events such as crises can be identified. However, to achieve a more accurate and reliable output, the analysis could be expanded to more advanced econometric models, such as Vector Auto Regression models (VAR). VAR can better analyze the relationships between certain variables. Many of the papers used for this thesis' literature framework based their scientific approach on VAR models (Kilian, 2009, p.1058). In order to prove the significance and robustness of the results in this thesis, test such as the Wilcoxon Rank Sum test (Fuentes, 2022). Conventional tests would not be conclusive, as they only apply to normal distributed data, which is usually not applicable to financial and economic data, even though it was log transformed.

Real GDP growth rates already depict the focus of this thesis; however, the macroeconomic performance and stability of a country can be measured through additional variables. Therefore, it could be interesting to look at interest rates and inflation rates in more depth to examine, if the buffer function of the GPFG also has an impact on these economic factors. Akram and Mumtaz include in their VAR-model the Nominal effective exchange rate, the Norwegian real GDP, the real Brent crude oil price, two types on inflation rates and the money market interest rate, for a better understanding of how these macroeconomic factors influence each other (Akram and Mumtaz, 2019, p.411). Instead of the nominal exchange rate, the real exchange could have been examined as well, as it is inflation adjusted and depicts effects in the long run. Furthermore, Beckmann and Czudaj argue, that the nominal exchange rate is way more difficult to link to the oil price as causality needs additional data (Beckmann and Czudaj, 2013, p.634). Instead of the nominal oil price, one could have also included the real oil price, as Bjørnland used it in her analysis on the Norwegian economy (Bjørnland, 2004, p.36).

Furthermore, the chosen subperiods of the first dataset differ in length. Due to the availability of the different time-series, the first time frame is smaller than the second. However, to cut the second subperiod, to make the comparison more equal, would minimize the possibility to show the mechanism of the fund, as in the early stages, the volume of the fund is still low

and the spending to support the budget deficit is just allowed in 2001. Nevertheless, the indirect buffer function, not through budget deficit balancing but buffering of the currency, could appear earlier than 2001, that is why the second subperiod starts in 1996. On the other hand, however one could also argue that real effects of the buffer can only be detected with the implementation of the ‘handlingsregelen’ and could identify the break from then on.

Concluding, despite the broad research on SWFs, it is however difficult to apply the results of such studies on a single SWF, especially the Norwegian fund. As stated in section 0 the definition of SWFs cannot be very precise, as SWFs exist in many different forms and can have different objectives. The GPFGs system is unique, also due to its size and the circumstance, that it is owned and governed by a democratic country, with a highly developed economic and financial system.

6 CONCLUSION

The Norwegian economy is heavily influenced by the oil industry. Despite the main oil sector, the service sector around the core business grew immensely over the last years. As oil plays a significant role in Norway’ economy and depicts a huge part of the country’s GDP, the world commodity price for oil is assumed to be equally important. As commodity prices, especially oil, are usually highly volatile, this leads to the question whether the oil price has a strong impact on the Norwegian economy or further the exchange rate of the country. In order to deal with the increasing oil revenue and the negative side effects of the resource boom, the Norwegian government set up a sovereign wealth fund. Many resource-rich countries establish SWFs in order to manage their commodity revenue for present and future generations and insulate the commodity industry from other industries in the country to maintain global competitiveness. When implementing the GPFG in 1990, the Norwegian government pursued similar motives. With the first payment in 1996, the fund acts for nearly 30 years now. Since then, the Norwegian economy grew continuously. This raises the further question, whether the GPFG can buffer the effects of crises and external shocks on the Norwegian economy and the exchange rate.

This thesis aimed on finding out, by the means of a descriptive analysis, how the oil price and the sovereign wealth fund influence the NOK and the stability of the economy. Therefore, the nominal USD/NOK exchange rate, the real GDP growth rate and the oil price were

examined, along with the fund structure and the withdrawals made each year in favor of the government budget. The results showed that in the short run, the oil price affects both exchange rate and real GDP. Further was the buffer function of the fund examined and whether it can prevent crises that affect the exchange rate and real GDP negatively. Firstly, derived from the results, one can say, that the overall economic growth of the real GDP growth rate increased and the volatility, excluding the Covid-19 pandemic, decreased over time. Moreover, the withdrawals showed, that during crises in the past, the budget could be adjusted through. However, further buffer functions arising solely from the fund could not be detected. The Fund is embedded in a stable financial and political environment, which allows it to grow steadily and generate additional wealth. Alongside other macroeconomic mechanisms, as policies (Larsen, 2006, p.636) and the exchange regime (Grigoli, Herman and Swiston, 2019, p.491), the fund helps to stabilize the economy, even though the specific stabilization factor of the GPFG remains uncertain. As the Norwegian government build up this macroeconomic foundation, it will be interesting to see how the Norwegian economy will handle external shocks and crises in the future and how the value development of the fund will proceed. This accounts especially for the time, that the oil production in Norway will slowly decline and come to a full stop in the distant future. Without the discovery of new oil fields on the Norwegian shelf, the oil production can live on for estimated 50 more years. It can be observed already that the fund structure shifted over the last years and the GPFG gained independence from the size of oil-inflows (see Figure 4). However, it will be interesting to see, how the fund and the Norwegian economy handle the declining revenue.

When looking at the nearer future, it is expected, that Norway has to deal with more frequent crises, especially political events. The Ukraine-Russia-war is still going on and further conflicts such as the Isreal-Palestine conflict emerged. In an interview, the Norwegian Minister of Finance, Jens Stoltenberg says, that the growing global market uncertainty is also affecting Norway (Norwegian Ministry of Finance, 2025). Just in the beginning of the year, when the Trump administration took over the presidency in the United States, the global economy was soon impacted by the tariff policies the administration set up. The Norwegian Stock Exchange fell 1.22% after the tariff set by Trump but the reaction was less severe than expected (NRK, 2025a). Increasingly problematic with political crises, problems of ethic investment arise. As the fund is characterized as a “moralist fund” (Clark, Dixon and Monk, 2013, p.68), the objectives sometimes conflict with investments in certain sectors and areas. The pure economic investment can be levied on a political level, as the recent divestment of

the fund in the construction company 'Caterpillar' caused tension between the Trump-administration and the Norwegian government (NRK, 2025b). This will make investing in the future increasingly difficult.

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APPENDIX

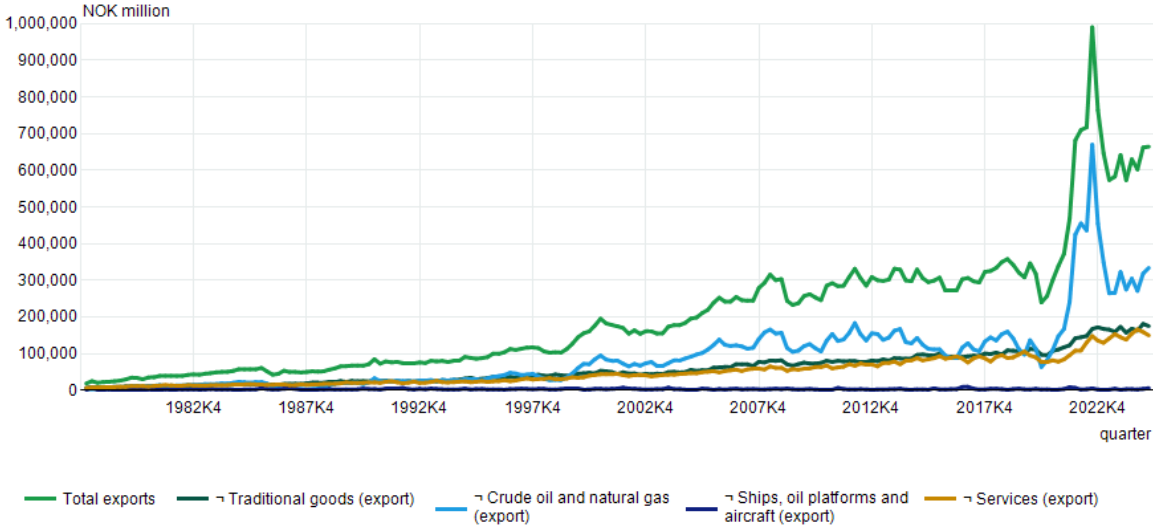


Figure 6: Exports of Norway divided into main business sectors, 1978 Q1-2025 Q1
 Source: (Statistics Norway, 2025c)

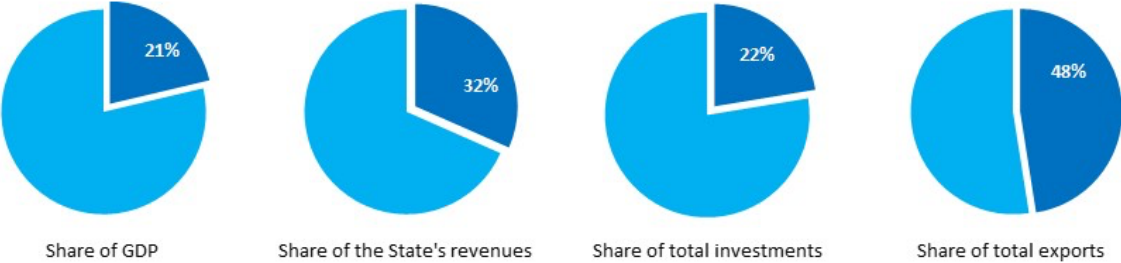


Figure 7: Share of petroleum industry in Norway's economy 2025 (services and supply sector not included)
 Source: (Norwegian Offshore Directorate, 2025c)

Figure 12.6. Organization of the Fund

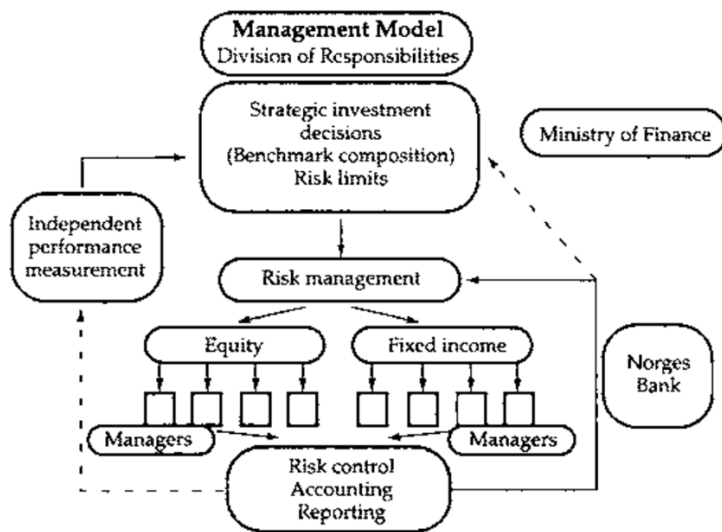


Figure 8: Organization of the Fund
Source: (Skancke, 2003, p. 329)

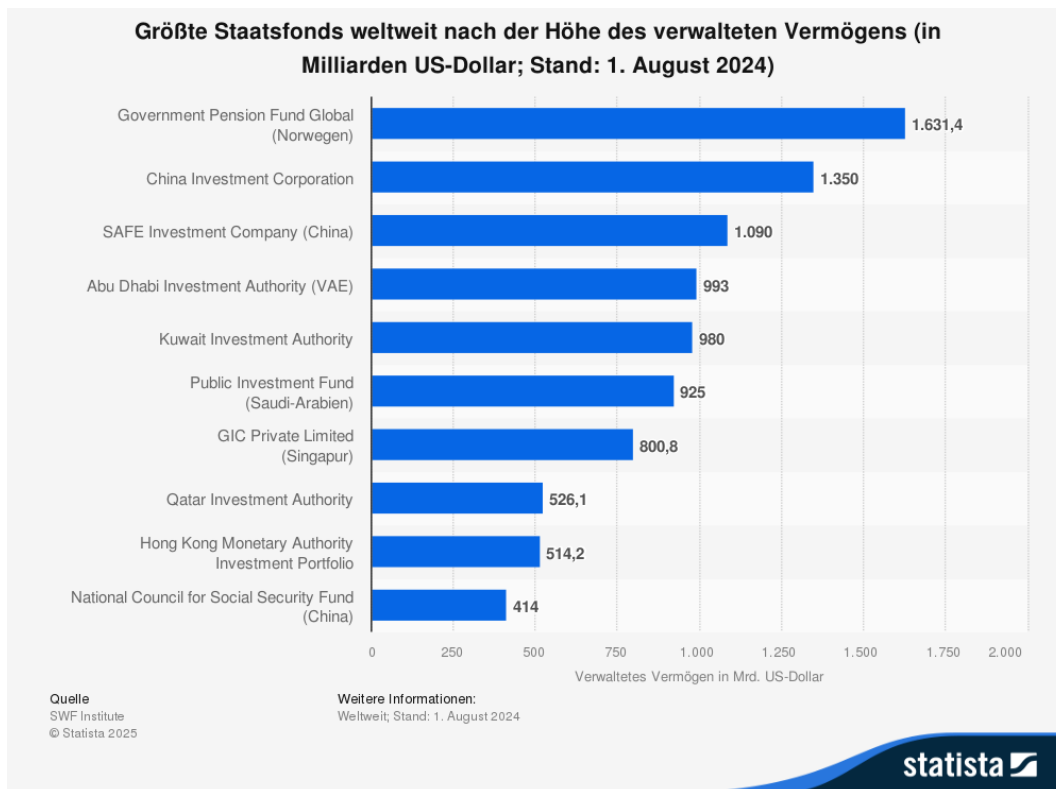


Figure 9: Ranking of the largest Sovereign Wealth Funds according to assets under management
Source: (SWF Institute and Statista, 2024)

Variables	Description
BRENT_OIL	Brent spot crude oil price in USD
USD/NOK_FX	USD/NOK exchange rate
REAL_GDP	Real GDP, inflation and season adjusted
Oil_rate	Log transformed BRENT_OIL
Fx_rate	Log transformed USD/NOK_FX
rGDP_rate	Growth rate of REAL_GDP
Subperiod	Periods dividing the dataset in pre and post implementation of GPF in 1996
Pre_GPF	First subperiod, before the implementation of the fund
Post_GPF	Second subperiod, after the implementation of the fund
Oil_abs	Absolute value of Oil_rate
Fx_abs	Absolute value of Fx_rate
rGDP_abs	Absolute value of rGDP_rate
fx_rollsD1	Rolling SD of Fx_rate with rolling window of 20 periods
rGDP_rollsD1	Rolling SD of rGDP_rate with rolling window of 20 periods
fx_rollsD2	Rolling SD of Fx_rate with rolling window of 28 periods
rGDP_rollsD2	Rolling SD of rGDP_rate with rolling window of 28 periods
fx_rollsD3	Rolling SD of Fx_rate with rolling window of 12 periods
rGDP_rollsD3	Rolling SD of rGDP_rate with rolling window of 12 periods
Diff	Difference of the associated variables
Ratio	Ratio of the associated variables
n	Number of elements
Alt	Alternative
Mean	Mean of variable
SD	Standard deviation

Table 7: Variables used in the calculations

Source: own illustration based on calculations

Data Series	Source
Crude Oil Price Spot Brent	Macrobond database, access 30/7/2025
USD/NOK Exchange Rate	Macrobond database, access 30/7/2025
Real GDP Norway	Macrobond database, access 30/7/2025
Fund Structure	(NBIM, 2025b)
Withdrawals from the Fund	Macrobond database, access 30/7/2025
GDP Mainland Norway	(Statistics Norway, 2025a)
Expenditure Central Government	(Statistics Norway, 2025b)

Table 8: Sources of Data series used for Calculations

Source: own illustration based on calculations

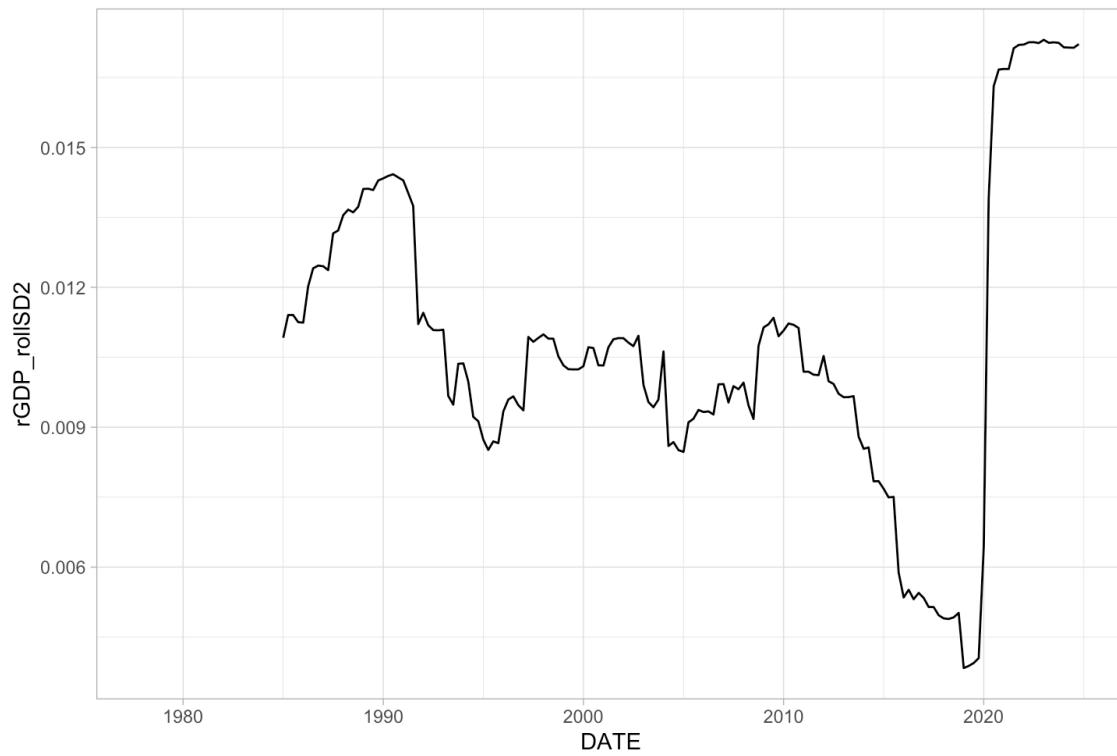


Figure 10: Rolling Standard Deviation of real GDP growth rate with a rolling window of seven years (28 periods)
 Source: own illustration based on calculations

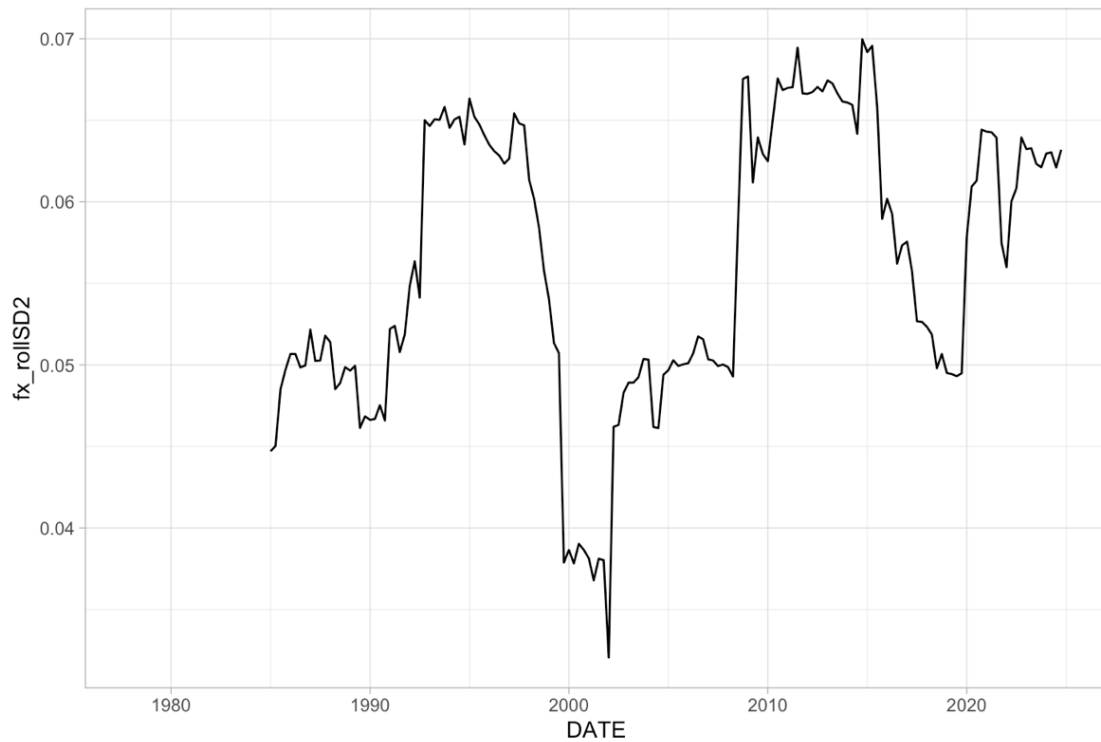


Figure 11: Rolling Standard Deviation of log USD/NOK exchange rate with a rolling window of seven years (28 periods)
 Source: own illustration based on calculations

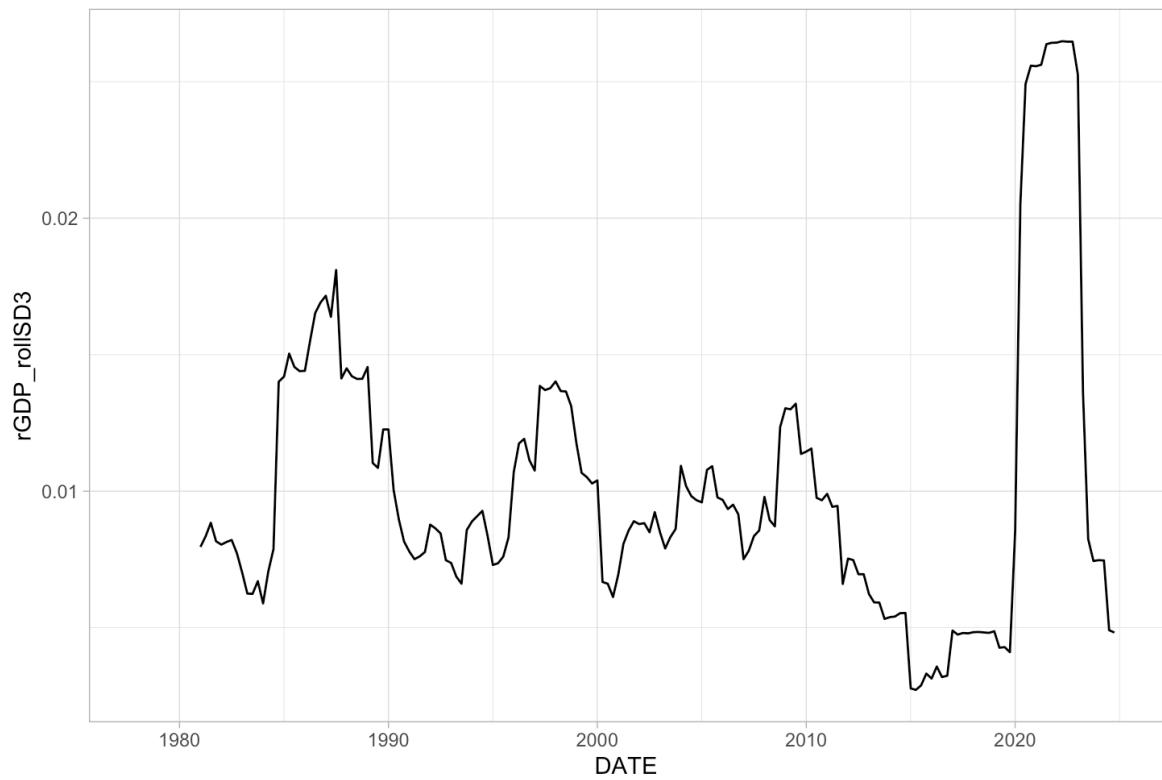


Figure 12: Rolling Standard Deviation of real GDP growth rate with a rolling window of three years (12 periods)
 Source: own illustration based on calculations

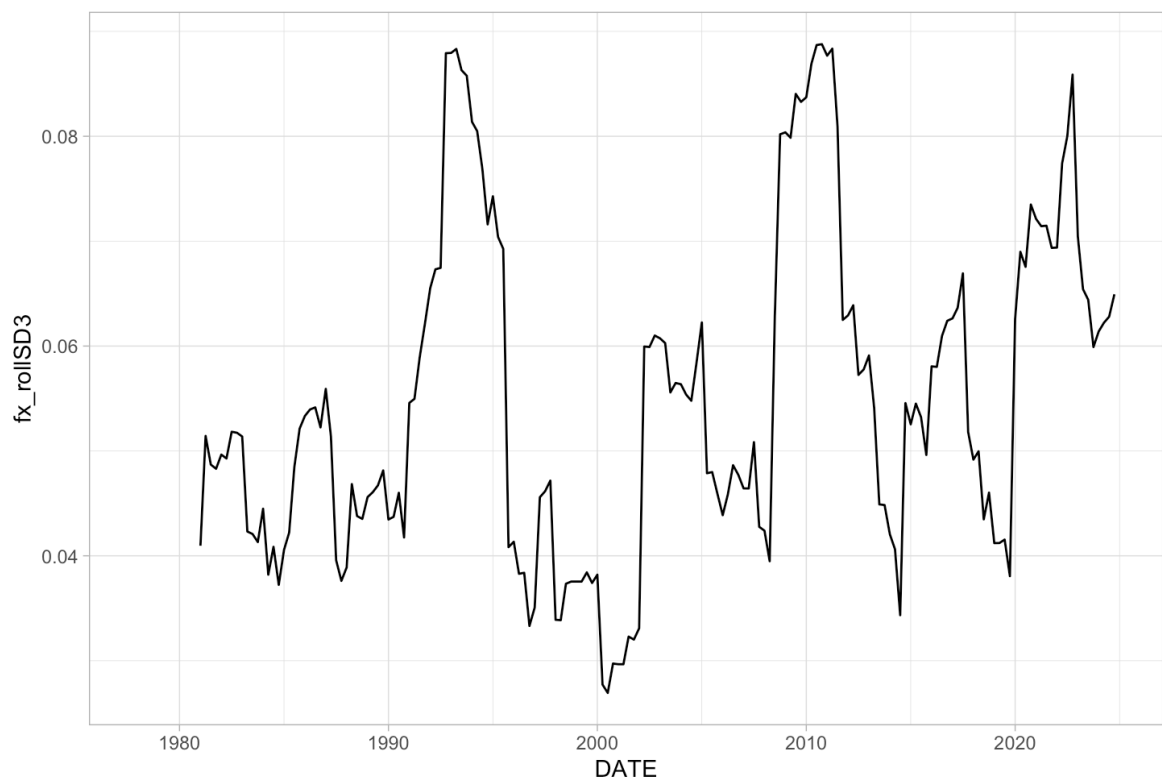


Figure 13: Rolling Standard Deviation of log USD/NOK exchange rate with a rolling window of three years (12 periods)
 Source: own illustration based on calculations

DECLARATION OF ORIGINALITY

I hereby formally declare that I have written the submitted thesis entirely by myself without anyone else's assistance. Where I have drawn on literature or other sources, either in direct quotes, or in paraphrasing such material, I have referenced the original author or authors and the source in which it appeared. I am aware that the use of quotations, or of close paraphrasing, from books, magazines, newspapers, the internet or other sources, which are not marked as such, will be considered as an attempt of deception, and that the thesis will be graded as a fail. In the event that I have submitted the dissertation – either in whole or in part – for examination within the framework of other examination, I have informed the examiners and the board of examiners of this fact.

Berlin, 15th September 2025

A handwritten signature in blue ink, appearing to read 'K. Ruy', is positioned to the right of the date.