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An outdated monetary action rule

How sensitive is the Norwegian economy to fluctuations in the oil fund and how to change the current monetary action rule

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Abstract

In this master's thesis, we have analyzed how dependent the Norwegian economy has become on the oil fund and its sensitivity to the size of its withdrawals. The government uses withdrawals to cover the yearly oil-adjusted budget deficits, and their size is governed by the monetary action rule.

The rule has been a guideline for the rate of integration of petroleum revenues into the economy. To analyze the dependency, we modeled how a 50 percent stock market crash would affect the share portion of the oil fund. We also looked at the impact on the fund of a significant de/appreciation of the Norwegian currency. We saw how these scenarios would affect the available funds to cover yearly budget deficits.

Analysis part one shows that the current monetary action rule has become outdated. One of the main reasons is the increased size of the withdrawals compared to the percentage of the state's total budgetary expenses. The fund's growth in value has resulted in the economy becoming too dependent on withdrawals since they show an increasing trend. The integration rate of petroleum revenues into the economy is not sustainable in the long run.

Analysis part two involves our different, viable solutions to the problem proved in the first part. The solutions we discuss are the cash flow method, the GDP method, lowering the current monetary action rule to 2 percent, and covering deficits by issuing debt. We have concluded that they could be a better solution to the current monetary action rule.

Acknowledgments

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Lastly, we would like to thank each other for two years of collaboration and friendship, which has resulted in a thesis we are very proud to present.

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Introduction

The oil-adjusted budget deficit (hereafter referred to as the OABD) was NOK 1,64 billion in 2001, while it was NOK 412,8 billion in 2021. Withdrawals from the oil fund (Statens Pensjonsfond Utland, SPU, in Norwegian and hereafter referred to the Government Pension Fund Global, GPFG in English) to cover the OABD now account for 26 percent of the government's total expenses budget. It accounted for less than 1 percent in 2001, when the monetary action rule (Handlingsregelen in Norwegian) was introduced. Therefore, this thesis will look at different aspects of how dependent and economically sensitive the economy has become to the size of the withdrawals from the GPFG.

We will look at government fiscal policy and different scenarios involving the GPFG and how it would affect the state budget. Fiscal policy refers to the stabilization policy pursued through the state budget (Meinich, 2021). Our focus is on the allowed 3 percent withdrawal from the GPFG, which is the current monetary action rule.

The monetary action rule is the rule which states the government can use 3 percent of the value of the GPFG over time. That means Norway can use more or less than 3 percent when needed. 3 percent is the expected real return from the fund's numerous investments (Regjeringen, 2018).

If the Norwegian currency appreciates or the world's stock markets are volatile, the monetary action rule could mean significant differences in the fund's value. That affects the ability to cover the yearly budget deficits. We will research an unexpected 50 percent stock market crash and a 30 percent currency appreciation and depreciation. For example, if the GPFG were to have a NOK 1 000 billion fall, Norway must reduce its budget deficit by NOK 30 billion (NOK 1 000 billion * 0,03). The example shows a weak point in the monetary action rule, and we want to discover how sensitive the Norwegian economy is.

Revenue from Norway's petroleum extraction has led to Norway being able to build the largest sovereign wealth fund in the world (Thomassen, 2022). It has greatly impacted the Norwegian economy and its ability to develop and maintain its welfare state. When politicians

decide on the state budget for the upcoming year, there is an OABD. It is covered by a transfer from the GPFG, which covers any deficit in the state budget balance (Regjeringen, 2021b). The Phillips Petroleum Company reported the first significant oil finding on Norwegian soil on December 23rd, 1969 (Regjeringen, 2021d). The field was called Ekofisk, and shortly after, new fields with more oil and gas were found (Regjeringen, 2021d).

The value of the GPFG has grown significantly over the last decade (Norges Bank Investment Management, n.d.-f). It is partly due to petroleum revenue added to the fund. In the later years, the currency exchange rate and returns on investments have increased the value. For example, the depreciation of the Norwegian currency has contributed to an almost NOK 2 000 billion increase in the value of the GPFG (Meld. St. 1. (2021-2022), p. 63). Though the fund has increased in value, there is no guarantee it will continue to do so.

At the same time, the yearly budget deficits covered by withdrawals have increased. Norwegian law states that the funds in the GPFG shall take care of long-term considerations when using the state's petroleum revenues. It is to benefit current and future generations (Statens pensjonsfond-loven, 2005, § 1).

Doubts remain as to whether it is sustainable for future generations when the current generations are taking larger and larger bites of the cake. Yearly withdrawals play an increasing role in fiscal policy (NOU 2016: 20, p. 14). We believe there should be a deeper discussion on the GPFG and its withdrawals to care for current and future generations.

The last couple of years have seen an increasing debate regarding the monetary action rule. Arguments state that it is outdated and should be changed or replaced. We discuss this in our analysis part one. Our analysis part two will discuss different alternative solutions to the current monetary action rule.

We have estimated and calculated several different scenarios to answer our research questions and discuss our hypothesis. The majority of data used to form our analysis and calculations was found in the yearly: state budgets, national budgets, reports, public records, and statements. The data are shown in the Appendix and supplement our analysis with tables, figures, calculations, and short explanations.

Research Question

The idea for our thesis is based on our interests in macroeconomics and because it is an important and debated matter. We have divided our thesis into two parts, and therefore, we have divided our research question into two parts.

In this regard, we have chosen our first research question to be:

Research question 1: "Has the Norwegian economy become too dependent on the GPFG? Is it due to the current monetary action rule?"

One argument regarding the monetary action rule being outdated is how the relationship between the GPFG and the state budget has changed in the last 10-15 years. It has yielded significant changes in the state budget capacity. If the government adheres strictly to the monetary action rule, fluctuations in the fund's value can result in large swings in available funds for withdrawal.

If the fund's value continues to increase, the current monetary action rule allows larger withdrawals from the fund. It can create a greater political negotiating room, allowing too large amounts of petroleum revenues to be phased into the economy at an unhealthy rate.

Geir Axelsen from SSB argues that the money used to cover the budget deficits should be connected to the fund's cash flow. That is because cash flows are more stable than the fund's value (Bjørnestad, 2021). He argues that this will give us a rule closer to what is and will be practical policy. It also has greater credibility as a long-term guideline.

In February 2022, Steinar Holden and his committee argued that we must quickly change the current monetary action rule. In addition, they concluded that there should be an investigation on how to change the monetary action rule to today's situation. In contrast, one alternative way is to use the cash flow method (Bjørnestad, 2022).

In 2015, professor Øystein Thøgersen and his expertise committee studied the monetary action rule. They researched how the rule had been used since its introduction and its possible usage in the future. They did it because of the fund's significant increase in value compared to

the anticipated value in 2001. Their report stated that they thought of discarding the rule as we know it and using the cash flow method instead (NOU 2015: 9, pp. 28, 217). The committee landed on a solution to decrease the monetary action rule from 4 percent to 3 percent. They proposed the solution to the government, and it was amended to 3 percent (Regjeringen, 2018).

The results in analysis part one formed the basis of the new possible solutions to the current monetary action rule. There will be a presentation and discussion of these in the analysis part two. Therefore, we have this as our second research question, with four hypotheses:

Research question 2: "If the monetary action rule is outdated as a tool for covering budget deficits, what solutions do Norway have?"

Hypothesis 2.1: The cash flow method is a better method to cover budget deficits than the current monetary action rule

Hypothesis 2.2: Using withdrawals from the GPFG as a fixed percentage of the GDP would be a better solution than the current monetary action rule

Hypothesis 2.3: It would be better if the monetary action rule were lowered to 2 percent

Hypothesis 2.4: It would be better if the Norwegian State borrowed money instead of making withdrawals from the GPFG to cover budget deficits

Structure of the thesis

This thesis starts with a brief introduction regarding the current rule, and then the research question is stated and discussed. To answer our research questions, we have completed background information regarding the GPFG and the current monetary action rule.

We have incorporated various economic and fiscal theories on fiscal policy to answer our research questions. These include the Norwegian governmental fiscal policy, discretionary fiscal policy, debt bias, debt unsustainability, and the currency exchange rate. Further, we described our methods to solve the different research questions.

Analysis part one elaborates on the problem with the current monetary action rule and how sensitive the Norwegian economy is. To complete our analysis, we calculated available fund withdrawals after a 50 percent stock market crash, and looked at petroleum revenue as a percentage of the GPFG. Further, we looked at how the state budget expenses have developed. Finally, we analyzed how changes in the value of the Norwegian currency can influence the available withdrawals from the GPFG. We subsequently discussed the consequences of the current monetary action rule and concluded.

In the analysis part two, we presented and discussed four different solutions to the outdated monetary action rule and concluded. Later, we discussed everything on a broader spectrum in the discussion before we concluded our thesis. Lastly, you can find our suggestions for further work, our references, and the Appendix.

Background

The Government Pension Fund Global

The first oil on Norwegian soil was reported in 1969 (Regjeringen, 2021d), and this, as well as others, has given Norway significant revenues and resources from petroleum production. In 1983, the Deputy Governor of the Norwegian Central Bank, Hermod Skånland, and his "Tempo committee" recommended creating long-term guidelines for the use of petroleum revenue, regardless of the activity on the shelf (Thomassen, 2022).

They suggested that the Government should create a "buffer fund" (Thomassen, 2022). By doing this, the fiscal policy and the use of petroleum revenues would be less vulnerable to fluctuations in the oil and gas prices. It would shield the economy (Norges Bank Investment Management, 2019c).

Primarily credited to the "Tempo committee", the "buffer fund" was established in 1990. It was initially called the Government Petroleum Fund but changed in 2006 to the Government Pension Fund Global (Thomassen, 2022). The name includes "Global" because the entire fund is invested abroad (Norges Bank Investment Management, 2019c).

The first transfer to the fund did not occur before 1996 (Norges Bank Investment Management, 2019c). At the beginning of the 1990s, the Norwegian economy was in a deep recession (SSB, 2005). From 1990 to 1995, the state budgets were in deficit, and therefore, no capital was added to the fund (SSB, 2005).

Since the first transfer to the fund, the fund's value has increased exponentially. In 2004, the fund's value hit NOK 1 000 billion, and by 2019, the GPFG had a market value of NOK 10 000 billion (Norges Bank Investment Management, n.d.-b). The value made it the world's largest state fund (Thomassen, 2022). As of 24.01.2022, the fund's value was NOK 12 007 345 200 491 (Norges Bank Investment Management, n.d.-e), and it owns almost 1,5 percent of all listed companies in the world. That corresponds to approximately 9 000 companies worldwide (Norges Bank Investment Management, 2019c).

Even though Norway transfers petroleum revenue in its entirety to the fund, the transfers now account for roughly 1 percent of the fund's value. See figure 7 in the analysis part one. The majority of the value of the fund comes from investments in different financial instruments, the currency exchange, real estate, and infrastructure for renewable energy. The investments are spread wide to reduce the risk of losing money through the fund (Norges Bank Investment Management, 2019c).

The Norwegian petroleum revenue has greatly benefitted and impacted the Norwegian economy. Oil and gas reserves are non-renewable (NOU 2015: 9, p. 45). That means they will decline and eventually be exhausted. The fund's purpose is to ensure Norway uses the money responsibly, ensuring that the wealth lasts as long as possible and creating a significant return so the fund grows (Norges Bank Investment Management, 2019c).

Yearly transfers from the fund cover state budget deficits (Norges Bank Investment Management, 2019c). The monetary action rule was established in 2001 to ensure responsible usage of the fund. It states that the use of the fund over time should follow the expected real return on the fund, which is estimated to be 3 percent (Regjeringen, 2018). It was 4 percent until 2016; more on this in the following subchapter.

Throughout this thesis, we will use the monetary action rule as what is "allowed" to withdraw from the GPFG. We know the withdrawals can and should be more or less than the rule, based on different times, situations, and the economy's general state.

The Monetary Action Rule

The Tempo committee first suggested the monetary action rule in 1983, but it would be many years before it became a reality. The Norwegian parliament introduced and passed the monetary action rule in the spring of 2001, and it was based upon a report made to the parliament the same year (Meld. St. 29. (2000-2001), p. 5).

The report detailed how revenue from petroleum production had been much greater in the past two years than it had previously been modeled or calculated (Meld. St. 29. (2000-2001), p. 8). This afforded much greater use of funds that the Norwegian government could implement in its fiscal policy and budgetary constraints. In addition, the Norwegian economy had been in a

prolonged period of economic boom with economic growth and a low unemployment rate (Meld. St. 29. (2000-2001), p. 8).

The report noted that there were budgetary challenges that had to be addressed. These challenges were an aging population with an anticipated greater pension and healthcare costs. The challenges were predicted to significantly increase in the future (Meld. St. 29. (2000-2001), p. 6). Another challenge was that the revenue from petroleum production would eventually decline and stop. It is due to either a changing demand for oil and gas, exhausted commodities in the Northern sea, or both. Those challenges forced Norway to think about sustainability for the future (Meld. St. 29. (2000-2001), pp. 6-7).

The report further stated that the size and value of the GPFG were expected to grow considerably. It would mean even greater funds available, which could be integrated into the economy through fiscal budgetary policy (Meld. St. 29. (2000-2001), p. 4).

The report stated that the government expressed a need for greater clarity on the strategy of the petroleum revenue (Meld. St. 29. (2000-2001), p. 8). This policy should support financial politics to achieve a solid and stable economic development when phasing in the petroleum revenue (Meld. St. 29. (2000-2001), p. 4).

The monetary action rule helps give a clear strategy for phasing petroleum revenue into the economy through fiscal policy and budgetary constraints. As noted in a message to the government in 2001 (Meld. St. 29. (2000-2001), p. 17), it is essential to manage the introduction of petroleum revenue into the economy. It would achieve balanced development and smooth out fluctuations in the economy.

The report expected the real return of the fund to be 4 percent (Meld. St. 29. (2000-2001), p. 9). The in-phasing of the petroleum revenue was expected to be done gradually (Meld. St. 29. (2000-2001), p. 22). This method would ensure the principal of the fund to not be reduced (Meld. St. 29. (2000-2001), p. 7)

To summarize, the monetary action rule was introduced to control the rate of the introduction of petroleum revenue into the Norwegian economy. It was because the revenue from the petroleum sector had been much more significant than first anticipated (Meld. St. 29.

(2000-2001), p. 8). It led to a more significant usage of the revenues. Norwegian politicians understood the future challenges and decided to solve the issue. It was done by limiting withdrawals from the GPFG to the expected real return of the fund, which then was 4 percent.

The Thøgersen report in 2015

It was decided in 2014 to commission an expert committee by the Stoltenberg government (NOU 2015: 9, p. 3). The committee was to evaluate the practice of the monetary action rule and how well the policy rules had been kept. It was regarding the integration of petroleum revenues into the economy during the last 13 years. Its purpose was to see the integration in light of the substantial growth in the fund's value and its challenges. Furthermore, they were to view the challenges already faced by the Norwegian economy in both the short and longer-term. The committee was headed by Professor Thøgersen (NHH) (NOU 2015: 9, pp. 3, 9).

The report made several conclusions in analyzing the usage of the GPFG and the monetary action rule. The Norwegian economy had become more dependent on the petroleum industry than anticipated in 2001 (NOU 2015: 9, p. 9). High oil prices had resulted in increased demand in the petroleum sector compared to other sectors in the rest of the country. It was also highlighted that a large fund could lead to large fluctuations in the expected return from one year to the next. When there are significant and long-lasting deviations from the 4 percent rule, the practice of the rule becomes more demanding (NOU 2015: 9, p. 9).

A strength of the monetary action rule, highlighted in the report, is the government's flexible use of the rule. It has resulted in the government keeping within the main guideline of 4 percent use of the fund (NOU 2015: 9, p. 9). However, the report highlighted several areas of concern. In 2015, a 3 percent return on the shares in the fund was more realistic than 4 percent (NOU 2015: 9, p. 181). The expected development in the fund's return was based on specific criteria, which was 3 percent over the next 15 years (NOU 2015: 9, p. 23). It argues for a reduced rule of 3 percent.

Petroleum revenues had been more quickly phased into the economy than anticipated. The report recommended that integrated petroleum revenues in the future had to be integrated slower than they had from 2001 to 2015 (NOU 2015: 9, p. 10). Further, it stated that if the government had continued with a 4 percent in-phasing of the fund's value, the maximum

allowed withdrawals would not correspond with increases in future government expenses (NOU 2015: 9, p. 9).

Since the fund's revenue comes from non-renewable energy sources, the benefits must be extended to all future generations. In addition, long-term interest rates had significantly declined, affecting the bond market, and were believed to continue for the next 10-15 years (NOU 2015: 9, p. 10). In other words, a lower percentage was more realistic.

The report anticipated that the fund could have extended periods of low or negative returns with an average of 2 percent each year for the next 10-15 years. Therefore, a lower withdrawal from the fund's value would be a more realistic long-term use of the fund (NOU 2015: 9, p. 10)

Different financial parties in the Norwegian Economy

Norges Bank is the Central Bank of Norway. Its purpose is to ensure stable inflation, financial stability and develop added value in investment management (Norges Bank, n.d.-a). The most important instrument the Central Bank has is the key interest rate (Norges Bank, n.d.-c).

The Ministry of Finance has the responsibility for government debt management. They have delegated all the operational tasks to the Central Bank. The Central Bank manages the outstanding national debt and covers the borrowing needs of the Government (Regjeringen, 2021f). Norges Bank Investment Management (hereafter referred to as NBIM) manages the GPFG (Norges Bank Investment Management, n.d.-d). The head of NBIM is Nicolai Tangen (Norges Bank Investment Management, n.d.-a). His overall responsibility is to implement the requirements that follow the governing documents. Those are established by the Executive Board of the Central Bank (Norges Bank Investment Management, 2019b).

The Ministry of Finance has many responsibilities. To name a few, it is the financial stability, planning and implementing economic-, budget-, and tax policy. They also set the framework for the fund's management (Regjeringen, n.d.-b). That is because they have the overall responsibility for the fund, which is delegated to NBIM.

The Norwegian fiscal policy

Basics of the Norwegian fiscal policy

Fiscal policy is government spending and tax policies. These will influence economic conditions, like the demand for goods and services, employment, inflation, and growth (Hayes, 2021b). The opposite of fiscal policy is monetary policy, which is the tool of the nation's Central Bank. It can promote sustainable economic growth by controlling the money supply in the economy (The Investopedia Team, 2021).

The fiscal policy is the stabilization policy pursued through the state budget and consists of public revenues and expenditures (Meinich, 2021). The fiscal policy is divided into expansionary fiscal policy and contractionary fiscal policy. When the government increases public spending or reduces taxes and fees, it is called an expansionary fiscal policy (Hayes, 2021b).

Expansionary fiscal policy fuels economic growth and stimulates private consumption. That usually helps to increase employment and prices. The policy leads to a greater budget deficit. Contractionary fiscal policies are the opposite of expansionary fiscal policies. It is characterized by a budget surplus, increased taxes, and reduced public spending (Hayes, 2021b). Contractionary fiscal policies are thus adjustments and changes to public expenditures or taxes, where the purpose is to reduce the level of activity in the society (Finansleksikon, n.d.).

The important instrument in fiscal policy is thus the budget deficit, with its revenues and expenditures. Compared to many other countries, Norway receives large revenues from its oil and gas commodities. Without the revenue from the petroleum sector, the state budget would be in a deficit[1] (Regjeringen, 2021e). When the politicians propose the state budget for next year, called Gul bok (Stortinget, 2021), it is divided into the structured oil-adjusted budget deficit (referred to hereafter as the SOABD) and the oil-adjusted budget deficit (OABD) (Regjeringen, 2021e).

[1] The budget is expected to give a deficit in 2022 of NOK 300,3 billion (the OABD)

The state budget is a proposal to the government. It contains an overview of all expenditures and revenues in all government activities in the next budget year. The state budget is presented in Prop. 1 S (Regjeringen, 2021e). The national budget is a briefing on how the government expects the country's economy to develop during the next budget year. In other words, the national budget provides the premises for political decisions and the government's economic policy (Stortinget, 2021).

The government presents the budgets in October, and the parliament comes with suggestions (Regjeringen, n.d.-d). By December 15, the parliament and the government must have decided on a budget they agree on (Stortingets forretningsorden, 2012, § 43). The budget they agree on is called a balanced budget (Fintland, 2018).

A budget deficit occurs when a nation's expenses exceed the nation's revenue (Barone, 2022). The OABD is the state budget deficit when revenue and expenditures from the petroleum industry are excluded. Money is transferred from the GPFG to cover the yearly OABDs (Regjeringen, n.d.-c).

With the OABD, the usage of petroleum revenues is separated from their earnings. A consequence of that is stability in the Norwegian foreign exchange market. It shields the state budget from fluctuations in oil- and gas prices (NOU 2015: 9, p. 35). The fiscal policy, therefore, avoids depending on the fluctuating prices.

The SOABD is adjusted for the effect of automatic stabilizers. That is because cyclical changes and other factors resulting in higher petroleum revenues in one period will, over time, be offset by lower petroleum usage in different periods (Buanes & Takla, 2018). In the SOABD, the effects of changes are excluded due to their assumptions of being quickly reversed (Staavi, 2017). The SOABD captures how the politicians organize the use of petroleum money, regardless of whether the economy is doing well or poorly.

Its purpose is to capture the underlying structure of budgetary policy (Regjeringen, n.d.-e). According to the monetary action rule, the SOABD must, over time, follow the long-term guideline of 3 percent of the fund's value by 01.01.XX. But, the actual withdrawal from the fund corresponds to the OABD. The SOABD is often called the "use of oil money" (Regjeringen, n.d.-e).

Automatic stabilizers reduce or increase the budget deficit due to the economy's overall health (Regjeringen, n.d.-a). In a boom period, tax revenues will increase, and payments to unemployment benefits will be reduced. The resulting budgetary improvement helps to curb the upswing in the economy.

If the economy enters a recession, the tax revenues will decrease, and payments to unemployment benefits will increase. The automatic stabilizers dampen the downturn and stimulate the economy (Regjeringen, n.d.-a). The monetary action rule is related to the SOABD and not the OABD. The automatic stabilizers must be allowed to work independently of the monetary action rule (Wulfsberg, 2019, p. 30).

Proposition 1 (Ministry of Finance 2021: 15) shows the key figures in the state budget for 2021-2022. The OABD for 2022 is estimated to be NOK 300,3 billion, equal to the amount withdrawn from the GPFG. The amount expected to be deposited to the GPFG in 2022 is NOK 277,1 billion, which gives a net deposit of NOK -23,2 billion. The national budget shows that the estimated SOABD for 2022 is expected to be NOK 322,4 billion (Meld. St. 1. (2021-2022), p. 58).

Fiscal theory for fiscal policy

The budget curve

The notes and definitions in the following subchapter are taken from two notes from Fredrik Wulfsberg, called “Noen nyttige makromodeller for norsk økonomi - Utkast” (Wulfsberg. F, 2019, 2021).

The budget deficit, -B

The primary deficit, -B, is the difference between a nation’s revenues, T, and expenses, G (Wulfsberg, 2021, p. 31). -B = T - G

If the budget surplus, B, equals -100, it is a budget deficit of +100. The larger the T, the higher the tax revenue, and thus the higher the budget surplus. The automatic stabilizers make the revenues vary co-cyclically, and the expenditures vary counter-cyclically. In other words, the budget surplus will vary co-cyclically (Wulfsberg, 2021, p. 31). Figure 1 below gives the rising curve as a function of the output gap, y-y*.

The oil-adjusted budget deficit, -Bo

The OABD is calculated since the petroleum revenues are fully transferred to the GPFG (Wulfsberg, 2021, p. 31). The OABD excludes petroleum revenue. Therefore, -Bo is: -B - Y, where Y is the petroleum revenue.

The structured oil-adjusted budget deficit, -Bo*

The SOABD is called -Bo* and is corrected for the effect of automatic stabilizers. It is not observable and is only a theoretical budget deficit (Wulfsberg, 2021, p. 31). The petroleum revenue is included in this budget. The SOABD should be 3 percent of the GPFG over time (Wulfsberg, 2021, p. 30).

Figure 1 below shows how the budget deficit, the OABD, and the SOABD are connected. To the left of B, there is a recession. To the right, there is a boom. The area above y-y* shows a budget surplus, while the area below y-y* shows a budget deficit (Wulfsberg, 2019, pp. 28-29).

(y-y*) gives the output gap, which is the difference between GDP, y, and the potential GDP, y*. ŷ is a given production gap that is negative, meaning y < ŷ. Bo(ŷ) is the oil-adjusted budget deficit when the production gap is equal to ŷ (Wulfsberg, 2019, p. 29).

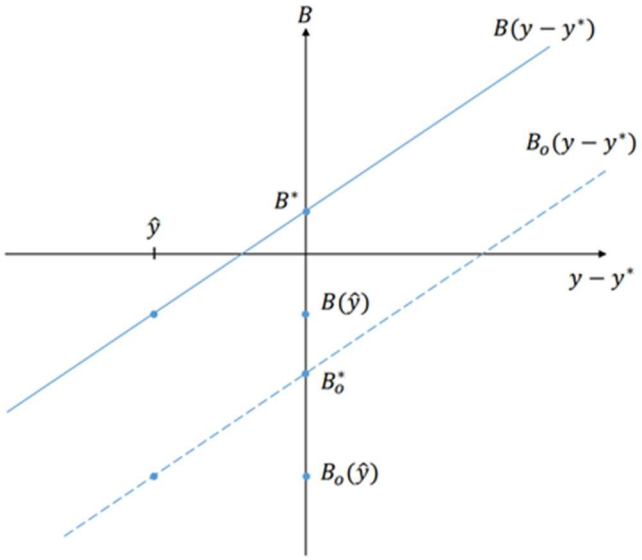

Figure 1: The budget deficit, the SOABD, and the OABD (Wulfsberg, 2019, p. 29)

Bo* illustrates the monetary action rule. The difference from B* to Bo* is Y, the petroleum revenue (Wulfsberg, 2019, p. 30). From the figure, we can see that Bo* > Bo if there is a recession, and it will be Bo* < Bo in a boom due to the automatic stabilizers (Wulfsberg, 2019, p. 30).

Basic fiscal theory

To help our thesis, we will discuss the IS and the Phillips curves shortly.

The Investment Savings curve

The IS curve represents the demand side of the economy, which refers to investments and savings decisions, ergo, the *I* and *S* (Carlin & Soskice, 2015, pp. 7-8). The IS curve shows the combination of interest rate and output and that aggregate spending equals output in an economy (Carlin & Soskice, 2015, p. 9). See figure 2 for the IS curve, which shows a downward-sloping relationship.

When interests are high, costs are larger on goods like housing, debt, and equipment. Therefore, spending will be lower, and hence, there is a downward-sloping relationship (Carlin & Soskice, 2015, p. 9). The interest rate is i in figure 2, while Y is the GDP.

The slope of the IS curve is called a1 (Wulfsberg, 2021, p. 34). It determines how much the change in interest rates affects society's overall demand, and it depends on the automatic stabilizers and the multiplier effect (Wulfsberg, 2021, p. 3). The automatic stabilizers affect the slope, while the discretionary fiscal policy changes the IS curve (Wulfsberg, 2021, p. 30).

Strong automatic stabilizers make the IS curve steeper (Wulfsberg, 2021, p. 3), but the IS curve is also affected by the real exchange rate, q (Wulfsberg, 2021, p. 19). If the exchange rate is depressed, it leads to a weaker Norwegian currency (Wulfsberg, 2021, p. 19).

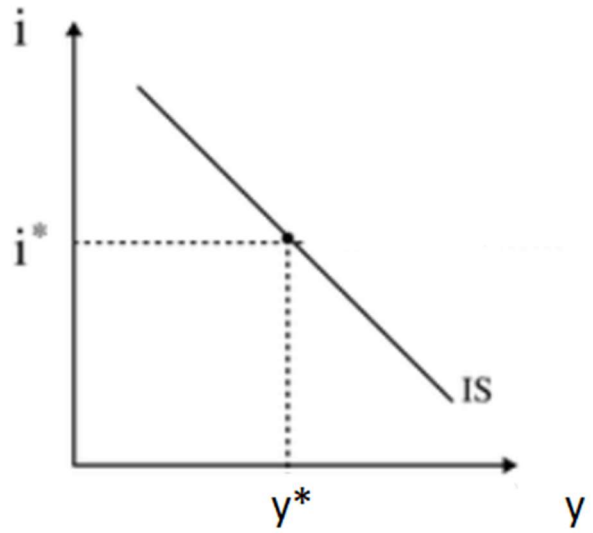

Figure 2: The IS curve (Carlin & Soskice, 2015, p. 10)

The Phillips curve

The Phillips curve represents the supply and labor economics sides of the economy (Carlin & Soskice, 2015, p. 45). It shows the upward-sloping relationship between inflation, π, and the GDP, Y; see figure 3 below. The slope of the Phillips curve is determined by ϒ1 (Wulfsberg, 2021, p. 12). The Phillips curve will be steep if the relationship between unemployment and wage growth is strong, but it is also affected by expected inflation (Wulfsberg, 2021, p. 4). The exchange rate, q, also affects the Phillips curve (Wulfsberg, 2021, p. 19).

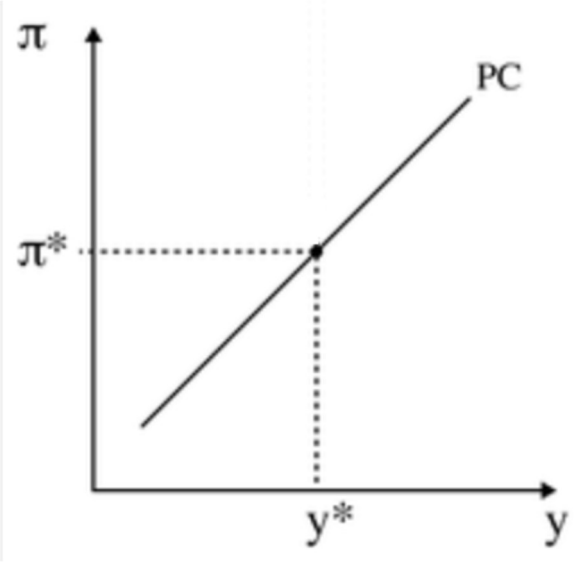

Figure 3: The Phillips curve (Carlin & Soskice, 2015, p. 67)

UIP: Uncovered interest rate parity

The UIP equation shows the relationship between exchange rates and interest rates; see figure 4. UIP stands for Uncovered Interest Rate Parity (Hayes, 2021a).

The theory states that a country with a higher interest rate will experience depreciation in its currency compared to foreign currency (Hayes, 2021a). If the interest rate rose in Norway, it would be more attractive to own NOK. Investors would demand NOK, and the demand would increase for NOK. For an investor to be neutral between buying NOK or another currency, the exchange rate, q, must fall. That is because the theory's basic premise is that the price of a good is the same everywhere (Hayes, 2021a).

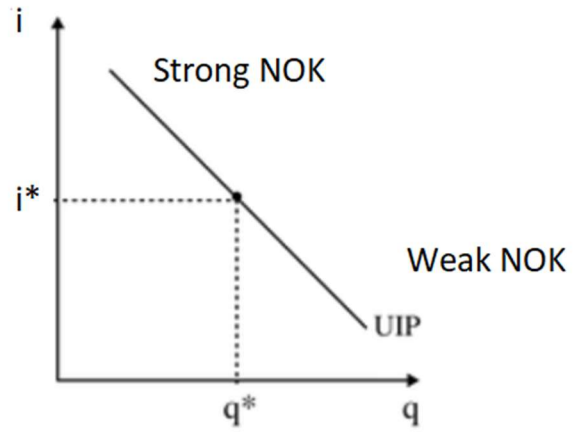

Figure 4: The UIP curve (Wulfsberg, 2021, p. 21)

Figure 4 is declining because a large interest rate corresponds to a low real exchange rate and vice versa. If the interest rate falls by 1 percent, the exchange rate will increase by 1 percent since the slope has a relationship of 1:1 (Wulfsberg, 2021, p. 20).

All of the figures together make the equilibrium:

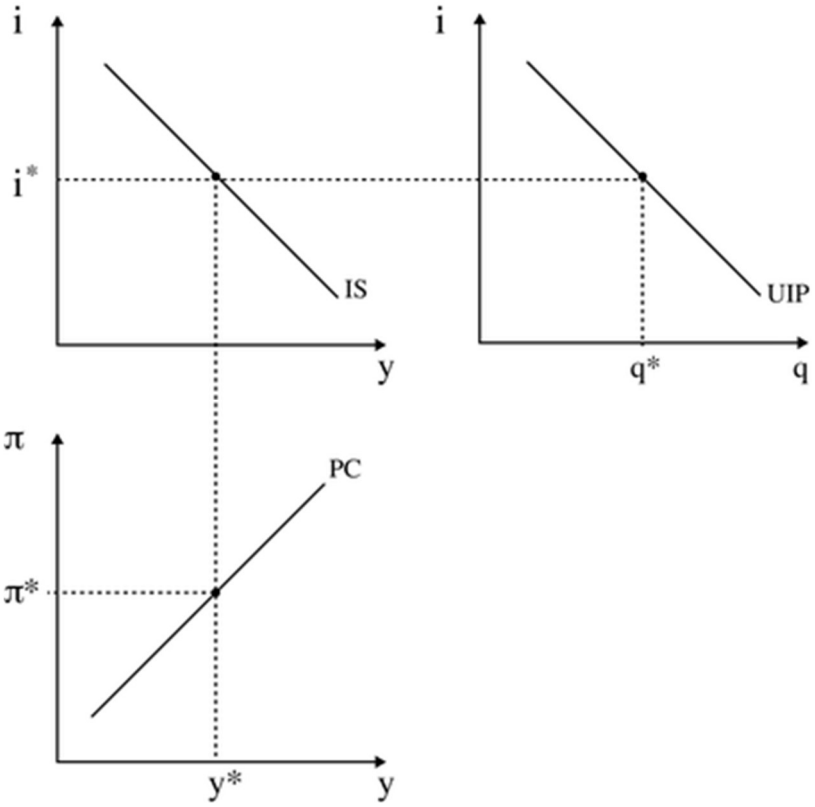

Figure 5: The IS curve, the Phillips curve, and the UIP curve

The difference between the actual production, Y (GDP), and the potential production, Y* (potential GDP), is called the output gap (Majaski, 2021). In the equilibrium, Y = Y*, $\pi = \pi^e$, q = q* and i = i* (Wulfsberg, 2021, p. 26). This is in absence of any shocks: $z^d = z^s = z^f = 0$. See Appendix for descriptions of these terms.

Discretionary fiscal policy

Discretionary fiscal policy is defined as a change in the structured oil-adjusted budget surplus, Bo* (note we use a surplus called Bo*, and not a deficit of -Bo*). It is changes in the Bo curve from figure 1 earlier (Wulfsberg, 2019, p. 31).

Discretionary fiscal policy is thus changes in the budget surplus, which is the surplus that is compatible with y = y* (Wulfsberg, 2021, p. 31). Discretionary fiscal policy is changes made by the government, which is supposed to influence the aggregate demand (Longdom, n.d.). Discretionary fiscal policy is determined by the monetary action rule, which will be equal to Bo(y-y*) in normal times and crosses B on Bo* (Wulfsberg, 2021, p. 31). Therefore, discretionary fiscal policy is the change in the structural oil-adjusted budget surplus, Bo*, i.e., a shift in the Bo curve.

To model fiscal policy in the IS-P-model[2], we must include automatic stabilizers and discretionary fiscal policy in the IS curve (Wulfsberg, 2019, p. 30). Discretionary fiscal policy can be interpreted as a demand shock that will shift the IS curve.

If there were an increase in the budget surplus, Bo*, it would reduce the demand for consumers, and the IS curve would change to the left (Wulfsberg, 2019, p. 31). There is a change in the IS curve to the right in figure 6 below. That is because the structural oil-adjusted budget surplus has been lowered. In other words, there is a larger deficit, meaning -Bo* increases. When -Bo* increases, politicians are carrying out an expansionary fiscal policy, where G (expenses) increase for the government or taxes are being lowered. That will stimulate the demand in the economy for a given interest rate. Hence, it will cause the IS curve to shift to the right.

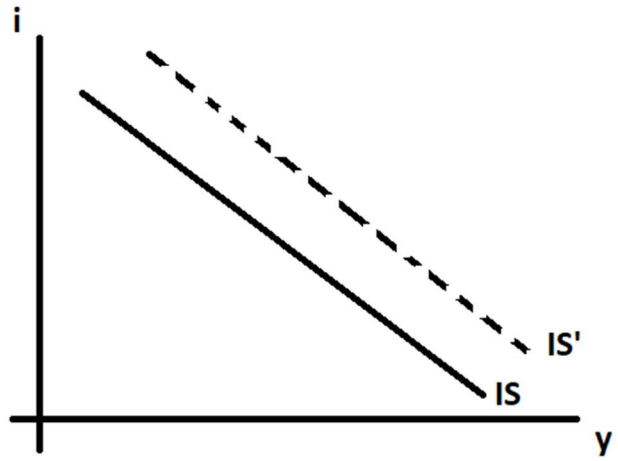

Figure 6: A demand shock affecting the IS curve

[2] The IS curve and the Phillips curve model

The reasoning behind government deficits

There are several reasons why a government chooses to hold a public debt rather than adjust taxes or expenditures each year to meet its budgetary constraints. The following section will detail the theories and reasoning behind this.

In situations where a country has a budget deficit, it can borrow money, which will increase the government debt (Khan Academy, n.d.). When looking at government debt and the choices taken by governments, a theory of stabilization and government choice was posited by Barrio in 1979. In the theory, he states that deficits are chosen optimally by governments to provide tax smoothing (Romer, 2012, p. 598).

Barrio's focus was on a government's desire to minimize distortions that occur when a government collects revenues. He observed greater than proportional distortions created by taxes in collecting revenues compared to the revenue raised. For lower taxes, the distortion costs are approximately proportional to the square of the amount raised. The distortions created are higher under a policy of variable taxes at the same average level. Therefore, this gives a government a reason to smooth the path of taxes over time (Romer, 2012, p. 598).

The model from Barrio implies that deficits arise when there is an expected change in the ratio of government purchases to output. Wars and recessions are two sources of predictable movements in the ratio of purchases. Government purchases are typically acyclical in relation to where the economy is within its economic cycle. In wars, revenues are not as high as total government purchases. Due to automatic stabilizers in recessions, there are greater welfare costs due to higher unemployment during recessions within a business cycle.

Government debt is public debt taken up by the state (Carlin & Soskice, 2015, p. 516). The government's debt includes Treasury bills, government bonds, and deposits by other state organizations (Regjeringen, 2020). Government bonds are a debt issued by a government to cover its spending and expenses. They are usually maturing between one to ten years, and they provide returns through their coupon (Chen, 2020). Treasury bills have a maturity of one year or less. They are also zero-coupon securities (Norges Bank, 2022a). The treasury bills will also be issued at a discount from their face value and redeemed when they mature (Hayes, 2021c).

Debt bias

There is a tendency for deficits to rise during recessions but not fall sufficiently during peak or boom periods (Carlin & Soskice, 2015, p. 535). This is debt bias. The OABD has increased enormously in the last ten years in Norway; see table 2 in the Appendix. This section will have several different theories to explain this phenomenon. Later in the thesis, we will discuss Norway's government debt and that Norway could cover budget deficits by borrowing instead of withdrawing from the GPFG.

Since 2007/2008, there have been many world crises, as we discuss further in the analysis part one. If we look at the OABD, it was four-doubled in 2021 compared to 2010. After the financial crisis ended, the OABD stayed around NOK 100 billion each year. Compared to 2008, it was NOK 11,8 billion. In 2014, the OABD was NOK 160 billion and has increased since. Analyzing the numbers in isolation, the financial crisis resulted in a permanent increase in the budget deficit, which has only worsened over time. See table 2 in the Appendix for the OABDs as of 31.12.XX.

The political-economic theory of debt has been put forward by various researchers (Romer, 2012, p. 605). One aspect of the theory posits that politicians and voters do not know enough about economics and therefore choose inefficient policies.

Each nation would produce greater total welfare by specializing in what they produce or do best (Feenstra & Taylor, 2017, p. 32). Countries continue to pursue policies that can be a source of the government acquiring and increasing debt rather than economic policies, which would be for the greater good in the long term for their economy. This theory is also argued by Buchanan and Wagner, which states that incomplete knowledge is an important source of debt bias (Romer, 2012, p. 606).

Another political cause for inefficient debt deficits is strategic debt accumulation (Romer, 2012, p. 606). One party increases the debt to restrain their successor's spending ability (Romer, 2012, p. 607). Another political source of debt accumulation is disagreement about dividing the burden of reducing the deficit between different political groups. One group hopes that delaying it forces another group to take a greater share of the burden and benefit

their group. However, the delay in reaching an agreement is detrimental to the economy, as posited by Alesina and Drazen (as cited in Romer, 2012, p. 607).

According to Grilli et al. in 1991 (as cited in Romer, 2012, pp. 623-624), long-lived governments that sit longer periods in power have lower deficits than short-lived governments (Romer, 2012, p. 624). This means divided governments and divisions of power within governments can negatively affect fiscal policy. A consequence can be greater deficits and delays in reform deficit decisions (Romer, 2012, p. 629).

A natural extension of our theoretical background is to include the problems arising from unsustainably high debt and risk premiums. Norway has a surplus of wealth due to the GPFG, valued at over three times Norway's GDP[3]. We feel any theoretical discussion regarding this is an improbable scenario for Norway that is not worth including in our master's thesis.

Debt unsustainability

The public debt is sustainable if the government meets its current and future payment obligations without financial assistance or defaulting (Hakura, 2020). Norway is a particular case since it uses withdrawals from the GPFG to cover budget deficits. Other less fortunate countries can cover the deficits by raising taxes, cutting spending, or creating new debt (Barone, 2022).

A country's debt-to-GDP ratio is the total debt of a country divided by the total GDP. It indicates a country's ability to pay its debts if the GDP is being used for repayment (Kenton, 2022). A country that can pay interest costs on its debt without destroying the growth of the economy is considered a stable country (Kenton, 2022). Therefore, we understand that debt is sustainable when the debt ratio does not grow over time.

If the total debt and total GDP grow at the same rate, the ratio will be constant. If the debt grows much more than the GDP grows, the debt will not be sustainable since the debt is an increasing share of the GDP. In addition, the interest costs will become larger and larger. The

[3] The GDP as of 31.12.21 was NOK 3 283 billion (Meld. St. 1 (2021-2022), p. 61). The number is found by: NOK 397,2 billion /12,1 percent. The value of the GPFG as of 31.12.21 was NOK 12 340 billion (Norges Bank Investment Management, n.d.-f). NOK 12 340 billion / NOK 3 283 billion = 3,8

fiscal policy and debt are sustainable when the growth, g, is larger than the debt's interest costs, r, meaning g > r (Carlin & Soskice, 2015, pp. 520-521). If not, interest payments take up more and more of the GDP, hence r > g. Consequently, the country might not be able to pay its interest costs or the overall debt.

We feel the situation Norway has with the GPFG is such that debt sustainability or unsustainability will probably never be an issue the country has to deal with. Therefore, we feel that summarizing the theory regarding debt (un)sustainability is sufficient for this thesis.

A country's currency exchange rate

A country's exchange rate is the value of one country's currency compared to another (Chen, 2021a). The exchange rate is an important determinant of a country's economic health (Twin, 2021). Exchange rates can be free-floating or fixed. A free-floating exchange rate will fall and rise due to changes in foreign exchange markets (Chen, 2021a). In contrast, a fixed exchange rate is pegged to another country's currency (Chen, 2021a). Pegging the exchange rate is to make their currency relatively stable and protect the competitiveness of exported products (Zucchi, 2021). Currencies are traded every day, at every time, and therefore the value of currencies fluctuates all the time (Gishen, 2021).

The GPFG is held in foreign currencies (Meld. St. 24. (2020-2021), p. 20). Therefore, the international foreign exchange market, and different international trade markets, affect the Norwegian economy. Different events affect global markets and currencies and, therefore, affect the Norwegian currency due to Norway being an open economy with a floating exchange rate (Meld. St. 29. (2014-2015), p. 16).

Method

To be able to answer our research questions, we collected a lot of data from many different sources. We used available information from government publications, various financial committee publications, the Norges Bank Investment Management yearly publications regarding the GPFG and state government fiscal budget reports. They form the backbone of our analytic data to answer our research questions.

The data we have collected is the value of the GPFG as of 01.01.XX and 31.12.XX. We also collected the yearly values for the last 22 years of the state budget total expenses, equity shares of the GPFG, the GDP of Norway, the cash flows, the oil-adjusted budget deficits, and the structured oil-adjusted budget deficits. We gathered the petroleum revenue of the last 20 years, the actual withdrawal from the GPFG in percent each year, withdrawal of the GPFG as a percentage of the GDP, and yearly interest rates on government bonds of 10, 5, and 3 years. The sources for the different data are pointed out throughout the text and in the Appendix.

We put all of the data into different folders in Excel and made different figures and tables to help us make our points. From the available data, we made our own numbers and data to help answer our research questions. More on this in the next chapter, called “Analysis and results.”

The data we used is reliable, viable, and from solid and respected sources. We believe that this gives credence to our thesis, as the backbone of our analysis and conclusions is from empirical data. This means our analysis and conclusions could be implemented in the real world. This might not have been the case if we had chosen a purely theoretical master’s thesis with no empirical or real-world data. Therefore, our analyses, discussions, and conclusions contain insights that are applicable to political policy, economists, and researchers looking in this field of research.

Analysis and results

We have divided the analysis into two. The first research question is if the Norwegian economy has become too dependent on the GPFG and if it is due to the current monetary action rule. Therefore, the first part of our analysis is called “the problem with the current monetary action rule and how sensitive the Norwegian economy is”. The second part of the analysis is regarding different solutions to cover budget deficits if the current monetary action rule is outdated. Therefore, the second part of our analysis is called “the solutions to an outdated monetary action rule”.

Analysis part one: The problem with the current monetary action rule and how sensitive the Norwegian economy is

This thesis aims to discover how dependent the Norwegian economy is on the GPFG. Today, Norway uses the monetary action rule as a rule of how much to withdraw from the fund (Regjeringen, 2019). We will analyze how sensitive the Norwegian economy is by making an example of a 50 percent yearly stock market crash and a large increase and decrease in the value of the Norwegian currency. First, we will discuss how petroleum revenues have changed as a percentage of the GPFG and the state budget’s total expenses.

Petroleum revenue as a percentage of the GPFG

Figure 7 below shows the Norwegian petroleum revenue as a percentage of the value of the GPFG. As the figure indicates, the percentage has dropped drastically from 2001 until 2021.

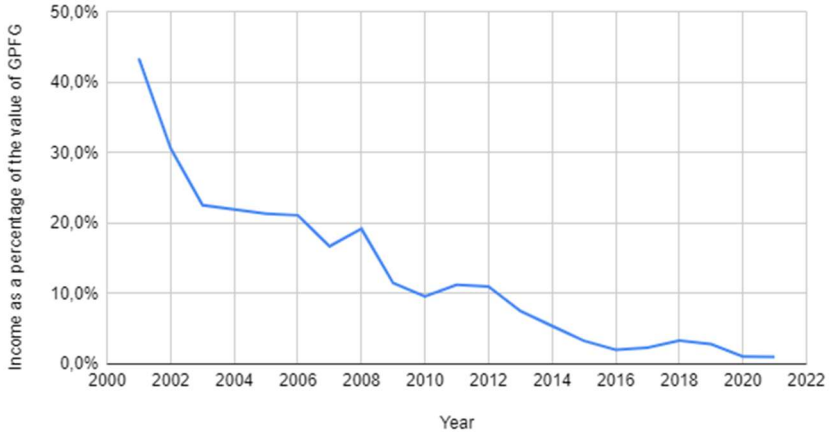

Figure 7: Petroleum revenues as a percentage of the value of the GPFG

In 2001, the percentage was 43,4 percent, while in 2021, the percentage was 1 percent, see table 3 in the Appendix. As of 31.12.01, the fund's value was NOK 619,3 billion, and the petroleum revenue was NOK 268,9 billion. The fund's value grew at an almost constant rate of around NOK 300 billion each year until 2010 to 2011; see table 2 in the Appendix. The increase in the fund from 2011 to 2012 was NOK 500 billion, but it grew with almost NOK 1 000 billion from 2012 to 2013. At the same time, the petroleum revenue fell from a high amount in 2012 of NOK 421,1 billion to NOK 378,7 billion in 2013. After that, the fall in petroleum revenues has been stable, and the revenues were NOK 114,7 billion in 2020. See table 3 in the Appendix.

The petroleum revenues have given Norway an important safety margin (Holden et al., 2022, p. 5). It is because the future petroleum revenues can fill a fall in the fund's value. If the revenues decrease, which they have, the safety margin also decreases (Holden et al., 2022, p. 5). In addition, petroleum revenues as a percentage of the fund's value now account for less than 1 percent of the total value. As such, a significant fall in the fund's value could not be filled by future petroleum revenues as it could have done previously.

In summary, the graph illustrates how petroleum revenue as a percentage of the value of the GPFG has changed over the years.

The state budget expenses

The total budgetary expenses have increased from NOK 516,8 billion in 2001 to NOK 1 595 billion in 2021; see table 4 in the Appendix. That is an increase of almost NOK 1 000 billion. At the same time, the GDP in Norway has increased from NOK 1 200 billion in 2001 to nearly NOK 3 300 billion in 2021, a difference of 2000 billion; see table 14 in the Appendix.

Table 4, shown in the Appendix, shows a sharp increase in the OABD over the last 20 years. Compared to the OABD, the total expenses of the state budget have increased significantly between 2001 and 2021.

In 2001, the OABD was NOK 1,64 billion, while it was NOK 412,8 billion in 2021. See Appendix for figure 15, which shows how the state budget's total expenses have increased more than the OABD over the last 21 years.

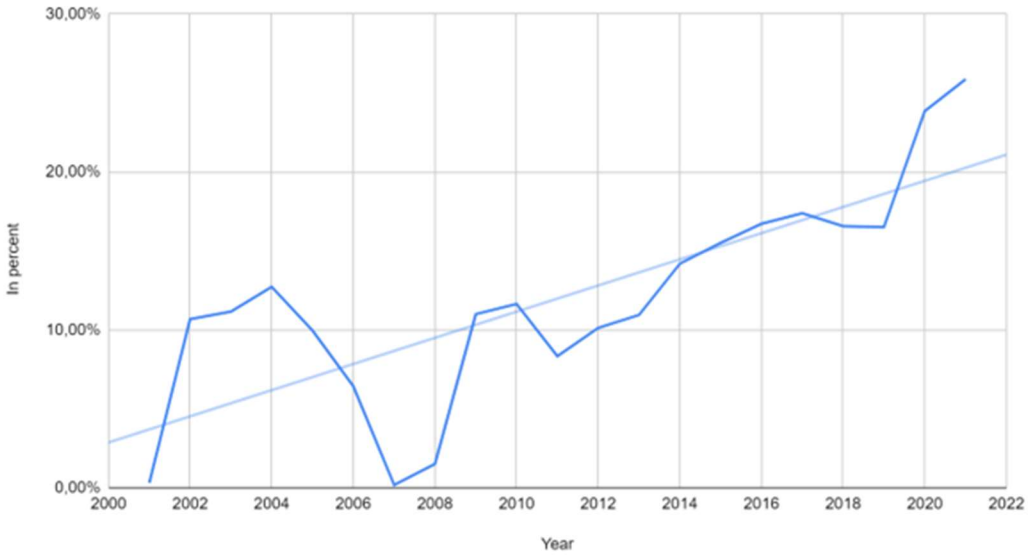

Figure 8: The OABD as a percentage of the state budget's total expenses

Figure 8 shows the oil-adjusted budget deficit as a percentage of the state budget's total expenses. The figure indicates an increasing trend line. The initial years from 2001 to 2008 showed some large fluctuations. It was because the total expenses were significantly larger than the OABDs. The actual change or increase from 2009 follows closely the trend line indicating significant increases each year. From 2010 until 2013, the percentage was steady at around 10 percent. In 2014, when the oil crisis happened, the oil-adjusted deficit as a percentage of the budget's total expenses stayed around 15-16 percent until 2019. In 2021, the percentage was almost 26 percent. See table 4 in the Appendix for the numbers.

One can summarize the change in the increase by stating that withdrawals from the GPFG now account for over one in every four kroner the government spends to cover budgetary expenses.

A 50 percent stock market crash

This subchapter will simulate a 50 percent stock market crash, its implications, and its consequences. We have chosen to simulate a 50 percent stock market crash each year from 2001 until 2021.

How common is a 50 percent stock market crash

A stock market crash is when there are rapid drops in stock prices. These drops are often unanticipated (Chen, 2022). Over the last 100 years, there have been several stock market crashes, and we will discuss them shortly in this segment.

There are many reasons why a stock market crash happens, but some of the reasons are side effects of major catastrophic events. Examples are wars, economic crises, investors' panic, or speculative bubble collapses (Chen, 2022). The most famous stock market crashes are the Great Depression in 1929, the oil crisis in 1973, the Black Monday in 1987, the dot-com bubble in 2001, the financial crisis in 2008, and the Covid-19 pandemic in 2020 (Chen, 2022).

The Dow Jones Industrial Average index measures the overall direction of stock prices of the 30 most traded stocks on both the New York Stock Exchange and the Nasdaq (Hall, 2022). The size of the crash on the Dow Jones Industrial Average in 1929 was -89 percent, the crash in 1973 was -46 percent, the crash in 1987 was -35 percent, the crash in 2000 was -83 percent, the crash in 2008 was -54 percent while the crash in 2020 was -38 percent. Therefore, the average size of the crashes is -57 percent (Moore, 2022).

During the last 93 years, there have been six major stock market crashes. What is noteworthy is that three crises have happened during the last 20 years. One can then argue and assume that crises will happen more often. At the same time, the years it took to recover from the financial crisis in 2008 and the Covid-19 crisis in 2020 was five years and one year, respectively (Moore, 2022). The recovery time from the Great Depression was 23 years, while the oil crisis in 1973 had a recovery time of 10 years (Moore, 2022). If the pattern follows in the future, we assume that crises will happen more often, but it may take less time to recover.

Based on historical data, we believe there is a possibility of a 50 percent stock market crash in the future. If not a 50 percent stock market crash, the data lends credence to a market crash in the future.

The difference in the monetary action rule before and after a 50 percent stock market crash

If the value of the equities in the fund were to fall 50 percent in the future, the fund's value would fall accordingly due to equities being around 70 percent of the total value of the fund

(Norges Bank Investment Management, 2022b, p. 7). A consequence is the lowered available funds to cover budget deficits.

Annual transfers from the GPFG cover the Norwegian state budget deficits. To simulate how dependent Norway is on the GPFG and its yearly withdrawals, we have simulated a 50 percent stock market crash for each year from 2001 until 2021. We found the value of the fund as of 01.01.XX and 31.12.XX, and the share of equities in the fund as of 31.12.XX, in percent and billions. To achieve a stock market crash of 50 percent, we multiplied the share of equities in billions by 0,5. We then found a new value of the GPFG as of 01.01.XX and as of 31.12.XX. See table 5 in the Appendix.

We got the fund's actual withdrawals which correspond with the OABD as of 31.12, from the national budget for 2022 (Meld. St. 1. (2021-2022), p. 199). We calculated the allowed withdrawal from the monetary action rule after the stock market crash, as of 01.01.XX and 31.12.XX. We also found the difference in the monetary action rule before and after the 50 percent stock market crash. See table 6 in the Appendix.

The difference in the monetary action rule before and after the 50 percent stock market crash starts at NOK 5 billion but ends up being over NOK 100 billion each year. In our calculations, we have used the 3 percent rule from 2017 and 4 percent from 2001 until 2016. The two last years have been exceptional due to the Covid-19 pandemic, but the difference has been above NOK 50 billion ever since 2014. Overall, the total sum of the difference is NOK 945 billion. See table 6 in the Appendix. We have collected the OABD as of 31.12.XX, the monetary action rule without a 50 percent stock market crash and the monetary action rule with a 50 percent stock market crash in figure 16 in the Appendix.

Figure 16 shows that the monetary action rule without a 50 percent stock market crash has been above the OABD since 2010, except for 2020 and 2021.

Assuming the monetary action rule has been 3 percent since 2001, it gives us another figure. Figure 9 shows the difference in billions in the monetary action rule with and without a 50 percent market crash. See table 8 in the Appendix for the numbers used here.

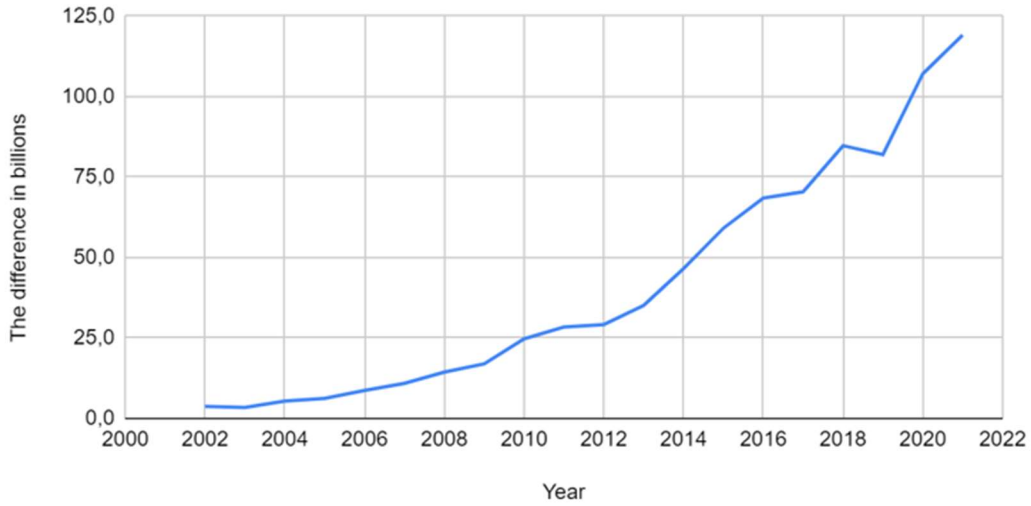

Figure 9: The difference between the 3 percent withdrawal with and without a 50 percent stock market crash

The graph shows that there is initially a slight difference in the allowed withdrawals. The graph shows an increasing trend line, meaning a 50 percent stock market crash would lead to greater differences over time. The difference has grown significantly since 2009, with the change in the rate of increase growing sharper after 2012. In 2001, the difference was NOK 3,7 billion, and by 2009 the difference was NOK 17 billion. In 2021 the difference was NOK 119,1 billion. See table 8 in the Appendix.

To summarize, the difference in figure 9 has increased rapidly after 2009 due to significant increases in the fund's value from 2009 to 2021. If we compare figure 9 with figure 16, the trend in the last figure provides a clearer picture. There is a clear change in the size of the withdrawals from 2009 and a clear, almost increasing linear trend line.

The Currency Exchange

This subchapter will simulate a large (de)apprecation of the Norwegian currency to help demonstrate how sensitive the Norwegian economy is. It will also show how dependent the Norwegian economy has become on withdrawals from the GPFG.

The GPFG is held in non-Norwegian currencies (Meld. St. 24. (2020-2021), p. 20). Therefore, significant changes in the value of the Norwegian currency will affect how much of the fund's value is being used to cover budgetary deficits for the government.

The national budget for 2022 shows that changes in the Norwegian currency have contributed to almost NOK 2 000 billion increase in the value of the GPFG (Meld. St. 1. (2021-2022), p. 63). Movements in the Norwegian currency exchange rate may intensify or counteract the fluctuations in the fund, which is held in foreign currencies. In the last 20 years, the Norwegian currency exchange has contributed to about 12 percent of the increase in the fund's value (Meld. St. 1. (2021-2022), p. 64).

A 35 percent stronger exchange rate is the "same" as a 50 percent stock market crash

The Norwegian currency is small globally (Brunborg, 2020). The GPFG is affected by factors outside Norwegian control, i.e., international financial markets. Therefore, the Norwegian currency is also affected (Meld. St. 24. (2020-2021), p. 10). A strong exchange rate will lead to a lower value of the GPFG. That is because the fund is only invested abroad and is held in foreign currencies (Norges Bank Investment Management, 2019c).

A 50 percent stock market crash could have the same consequences as a strong exchange rate. The 50 percent stock market crash only affects the shares, not the fund's bonds and other financial instruments. A stronger exchange rate would affect the whole fund since the entire fund is invested abroad (Norges Bank Investment Management, 2019c).

If we compare a 50 percent stock market crash with a stronger exchange rate, the exchange rate will not need to fall 50 percent to yield the same consequences as the market crash. The GPFG consists of an equity part of 70 percent (Regjeringen, 2021a). If the value of the shares remains constant, but the Norwegian currency strengthens by 35 percent, it would be equivalent to a 50 percent fall in the value of the shares portfolio. For example: 0,70 * 0,5 = 0.35.

To summarize, a 50 percent market crash would be the "same" as a 35 percent strengthening of the Norwegian currency.

The probability of a 35 percent decrease/increase in the currency exchange rate

The national budget for 2022 **(**Meld. St. 1. (2021-2022), p. 201) documented the expected future change in the value of the GPFG. There has been a Monte Carlo simulation used to determine the possible future market values of the fund. To do that, many different factors and scenarios determine this.

In the calculations of the change of the currency exchange rate, there is an 8 percent standard deviation. It is based on historical time-series data regarding currency exchange changes between 1998 and 2020 (Meld. St. 1. (2021-2022), p. 201).

To achieve a 35 percent change in the Norwegian currency, we used the standard deviation the GPFG has calculated and used in their modeling for possible future values of the fund. They have calculated the possible currency deviation by looking at the historical data. It was data from the last 25 years of the changes in the currency exchange rates of the Norwegian currency. Using the same assumption as the GPFG, it would be 4,5 standard deviations to achieve a change of 35 percent[4]. In other words, there is a very low probability of a 35 percent appreciation in the Norwegian currency exchange.

In contrast, an 8 percent deviation in the fund's value represents a significant swing in the possible value of the fund due to its size. If the fund at 01.01.XX is worth NOK 12 000 billion, then a decline or increase of 8 percent is NOK 11 040 billion and NOK 12 960 billion, respectively. This would equate to a NOK 57,6 billion[5] difference in available funds to the government, representing a significant difference in the state budget.

Although the data from figure 10 shows no sudden 35 percent change in the value of the NOK, an almost 30 percent change happened in 2008/2009. That was due to the financial crisis. Based on this empirical data, we will use this percentage to analyze the possible effect on the available withdrawals from the GPFG.

[4] 35 percent / 8 percent = around 4,5 standard deviations

[5] NOK 12 960 billion - NOK 11 040 billion = NOK 1 920 billion. 3 percent of NOK 1 920 billion is NOK 57,6 billion (NOK 1 920 billion * 0,03)

Figure 10: The Norwegian currency exchange rate against Euro, from 04.01.1999 until 21.03.2022 (Norges Bank, n.d.-d)

Figure 10 above shows the Norwegian currency exchange rate against EUR from 04.01.1999 to 21.03.2022. It shows a change in the Norwegian exchange rate for each global crisis, which is a value depreciation, i.e., the depreciation of March/April 2020 was due to Covid-19.

After a major shock and depreciation of the Norwegian currency, a general trend is that the exchange rate slowly starts to appreciate. Still, there are no sudden large appreciative value changes, as seen with the depreciation.

For example, on April 1st, 2020, the value was 11,26, and on January 3rd, 2022, the value was 10,00 (Norges Bank, n.d.-d). It took nearly two years to achieve an 11,19 percent appreciation in the Norwegian currency against the EUR[6]. This appears to be the pattern observed for the Norwegian currency.

To summarize, a 35 percent appreciation of the Norwegian currency exchange rate is very unlikely and not very common.

[6] (11,26-10) / 11,26 = 0,1119

How could a change in the value of the Norwegian currency affect withdrawals?

A 30 percent depression/appreciation of the Norwegian currency

Based on the empirical data above, we will analyze a 30 percent depression/appreciation of the Norwegian currency. To analyze how it would affect the fund's value, we used the value of the fund as of 31.12.XX in NOK. Then, we calculated the acceptable withdrawal for that year (3 percent from 2017 and outwards). We calculated a 30 percent appreciation and a 30 percent depreciation of the currency. See table 9 and table 10 in the Appendix.

We compared the current monetary action rule with the depreciation and appreciation of the Norwegian currency for the last 20 years. When the fund's value was low compared to today, there was a low difference in the fund's value if the currency exchange were to appreciate and depreciate 30 percent. The total difference in the first year was NOK 14,9 billion, and by 2017, the difference was NOK 152,7 billion. Apart from the sudden change after the oil crisis in 2014 and the adjustment in the monetary action rule in 2017, we found a linear increase in the difference pattern. In 2020, the difference was almost NOK 200 billion. See table 9 and table 10 in the Appendix.

In contrast to the difference of NOK 181,6 billion in 2019, the withdrawal from the GPFG was NOK 227,6 billion (see table 2 in the Appendix). Our analysis and data show that the value of the Norwegian currency can significantly impact the total amount of fiscal spending available to any government. That may create political pressures to use more oil money. It is not improbable that the Norwegian currency could depreciate due to world conflict.

In summary, if the fund's value were to increase significantly, combined with a depreciated currency, it could lead to a tremendous value for the fund. 3 percent of an ever-increasing fund creates extreme margins to cover the budgetary deficits.

Consequences of the current monetary action rule

The current monetary action rule leads to large variations in what is allowed to be withdrawn each year due to the fund's value change. Assuming the monetary action rule was 3 percent from 2001 until 2021, the yearly allowed withdrawal varies from NOK 11,6 billion to NOK

327,2 billion. See table 11 in the Appendix. It leads to significant deviations in the fiscal policy and thus the amount to cover budget deficits.

At the same time, the OABD as a percentage of the state budget's total expenses has increased significantly. The current withdrawals from the fund account for over one in every four kroner (around 26 percent) in the budgetary expenses to the Norwegian government. Earlier, this percentage was about 15 percent. This argues that the Norwegian government is more and more dependent on the withdrawals to cover budget deficits. Petroleum revenue deposited into the fund is declining. If the fund's value were to decrease due to a 50 percent stock market shock, the allowed withdrawal would decrease, making it harder to cover the increasing budgetary expenses.

When comparing the allowed withdrawal after a 50 percent stock market crash (see table 6 in the Appendix) with the OABD (see table 2 in the Appendix), the allowed withdrawals after 2016 are less than the budget deficit. It shows a negative consequence of the current monetary action rule. The Norwegian government has become dependent on the size of the fund's value to continue its level of withdrawals.

If there were a stock market crash, the difference in the allowed level of withdrawals could be that the government could choose to keep the withdrawals at the same level as before. That would be to maintain stability in the economy. A consequence is that the fund's principal would begin to erode. It is not possible to say how long such a policy would be allowed to continue. The difference in the last few years would imply large budgetary cuts needed to balance the budget.

A goal of establishing the GPFG was to lower the danger of significant and unnecessary fluctuations in the Norwegian economy. Hence, to smooth out swings in the economic cycle (NOU 2016: 20, p. 14).

Theory from Romer regarding the need for economic stability (Romer, 2012, p. 530) implies that the government could experience difficulties in making large budgetary adjustments. The current monetary action has resulted in large withdrawals, which implies that the government has grown dependent on its size. That makes change difficult. Even though the yearly OABDs are increasing, they are increasing more after a negative shock. One can look at the deficits

after the financial crisis and the oil crisis. Both show an increase in the level of the OABDs compared to before.

Larger deficits and withdrawals could be made simultaneously when the fund's value decreases 50 percent. Therefore, there would be larger and larger erosion of the fund's capital. As of the theory and evidence presented surrounding debt bias, it would probably be unlikely that these levels of withdrawals would quickly decrease to keep within the 3 percent rule. It appears that the level of withdrawals after any financial crisis never reduces back below previous levels.

Consequences showed with a figure

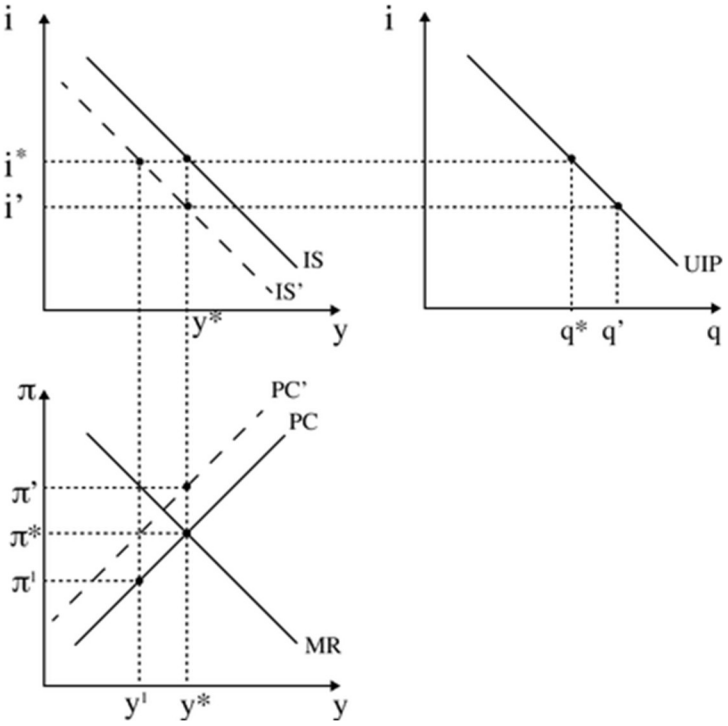

Figure 11: A negative demand shock (Wulfsberg, 2021, p. 25)

The consequences on the real economy can be illustrated by a simple theoretical framework from the theory part. The stock market crash can be illustrated as a negative demand shock, in figure 11. A 50 percent market crash would affect the fund's value and, therefore, decrease the amount of the allowed withdrawals.

The figure is made as a simplification and does not fully reflect the consequences on the real economy. We start at the equilibrium with y*, i*, q* and π*. The negative demand shock causes the IS curve to shift to the left. There would be a decline in the total demand in the economy, and the new equilibrium y is y1. This is due to the government having to decrease total spending so it would be unable to buy as many goods and services as before.

In this model framework, the GDP would decrease. This can be demonstrated through the change in the GDP. In 2021, the GDP for mainland Norway was NOK 3 283 billion. The difference in available funds to withdraw in 2021 following a 50 percent market crash would be NOK 119,1 billion; see table 6. If for example the multiplicator is equal to 1, the decrease to the GDP would be NOK 3 163,9 billion[7], i.e., a 3,6 percent[8] contraction of the economy. This is illustrated in the figure by y1, and as we can see from the Phillips curve, a lowered inflation to π1.

To counteract the decrease in demand and services, the Central Bank could decrease the interest rate, to i'. See figure 11. This would fully negate the decrease in the demand as it would stimulate and increase the overall demand in the economy (Kramer, 2021). Because of the depreciated currency (an increased q to q'), the cost of import goods would increase. This would increase inflation and result in the Phillips curve moving to the left.

A decrease in the interest rate to counteract the decrease in government expenditure will cause a move along the UIP curve to the right. The Norwegian currency will be worth less due to the lowered interest rate (Lioudis, 2021). The new equilibrium will be y*, i', q' and π'.

Analysis part one: conclusion

The analysis part one discussed the problem with the current monetary action rule and how sensitive the Norwegian economy is. The monetary action rule was introduced in 2001. Its purpose was to control the rate of the petroleum revenue into the economy and create an anchor for the budget policy (Meld. St. 29. (2000-2001), p. 17) and sustainable growth (Meld. St. 29. (2000-2001), p. 19). The rule has helped protect the economy from fluctuations in

[7] NOK 3 283 billion - NOK 119,1 billion = NOK 3 163, 9 billion
[8] NOK 119,1 billion / NOK 3 283 billion = 3,62 percent

petroleum revenues and has separated the fiscal policy from the oil and gas prices (NOU 2018: 12, pp. 8, 12).

The fund's growth has resulted in it no longer being dependent on new transfers from petroleum revenues. As a percentage of the value of the GPFG, they account for 1 percent today, while it was over 40 percent in 2001. The fund is now less dependent on the price of oil and gas and more dependent on shocks, stability, and returns of the different financial markets (Meld. St. 24. (2020-2021), p. 10).

Figure 8 shows that withdrawals from the GPFG today account for 26 percent of what the government spends to cover budgetary expenses.

We simulated a 50 percent stock market crash to answer our research question. Our analysis supports our hypothesis that the economy has become too dependent on the GPFG. Early on, the value of the fund was less than today. Therefore, a 50 percent crash would not have impacted the funds available to cover a budget deficit, compared to the last couple of years.

There have been six major market crashes in the last 100 years, but three have occurred in the previous 20 years. This argues for them being more common. At the same time, the time it takes for the economy to recover has decreased dramatically. Therefore, we assume that a stock market crash can happen in the future, but the recovery time can be much less than 50 years ago.

When comparing withdrawals with and without a stock market crash with a fixed monetary action rule of 3 percent, the difference has increased significantly in the last 21 years. It gives credibility to our research question 1. The difference in 2021 from our simulation shows over NOK 100 billion. See table 8 in the Appendix.

Today, the accumulated value of the exchange rate change makes up NOK 2 000 billion of the GPFG. In our analysis, we have compared the current monetary action rule with the depreciation and appreciation of the Norwegian currency over the last 20 years. The difference started at NOK 14,9 billion in 2001, and by 2020, it was almost NOK 200 billion. This leads to large possible deviations in the budgetary deficit. See table 9 and 10 in the Appendix.

A 50 percent stock market crash could lead to the same consequences as a strong exchange rate. Since the GPFG consists of an equity part of 70 percent (Regjeringen, 2021a), a 50 percent market crash would be the same as a 35 percent strengthening of the Norwegian currency. Our analysis also shows that the probability of a sudden appreciation/depression of the Norwegian currency by 35 percent is unlikely. We believe a currency's 30 percent appreciation/ depression is more likely based on our analysis.

We believe the answer to our research question 1 is yes. In the second part of our analysis, we will present different solutions to change the outdated monetary action rule.

Analysis part two: The solutions to an outdated monetary action rule

In recent years, there have been regular discussions regarding the monetary action rule and the use of funds from the GPFG. Is the amount too much? Is it sustainable? How will this affect future generations? How dependent is Norway on the petroleum revenue in the fund? What happens when no "black gold" is left in the North Sea?

Our analysis part one indicates that the Norwegian economy has become too dependent on the GPFG. The GPFG has grown significantly in the last ten years due to a sharp rise in international share prices, petroleum prices, and a weaker Norwegian currency (Meld. St. 1. (2021-2022), p. 55). In addition, the GPFG has grown faster than expected (Meld. St. 1. (2014-2015), p. 63). Analysis part one also indicates that the value of the GPFG can lead to large deviations in the yearly budgets. Further, this indicates that the dependency or level of withdrawals is not sustainable for future generations. It argues that the current rule is outdated. See table 2 for the OABDs in the Appendix.

The withdrawals from 2017 to 2021 have been larger than withdrawals with the 4 percent monetary action rule from 2001 to 2016. There have been extremely large withdrawals in the last few years, but the withdrawals in percent[9] were still less than 3 percent (except for 2020 and 2021 due to Covid-19, when the percentage was 3,6); see table 2 in the Appendix. We

[9] The SOABD as a percentage of the GPFG as of 01.01.XX (Meld. St. 1. (2021-2022), p. 61).

believe it is a problem that the withdrawals are reaching new heights and above the levels before the monetary action rule was amended. This further argues the need for a new rule on covering budget deficits.

In the national budget for 2015, some concerns were shown for the future expected return on the fund. It concerned the size of the state's other revenues and the size of the Norwegian economy (Meld. St. 1. (2014-2015), p. 7). It was argued that the expected real return of 4 percent of the fund was a less suitable target for the fiscal policy of Norway in the short term. Since the fund today is much larger than it was earlier and only continues to reach new heights, should there not be further discussion around the percentage?

There have been recent discussions regarding the current monetary action rule. In February 2022, Steinar Holden and his committee concluded that Norway needed to adjust the current monetary action rule (Holden et al., 2022, p. 13). In 2021, Hilde Christiane Bjørnland (Professor at BI) wrote a post in Dagens Næringsliv about how Norway needs new rules for using petroleum revenue (Bjørnland, 2021). In 2015, Øystein Thøgersen and his committee stated that the rule should be discarded, and the cash flow method could be used since it would help deal with uncertainty (NOU 2015: 9, pp. 28, 219). In 2021, the CEO of SSB, Geir Axelsen, said Norway needed an adjusted monetary rule that uses the cash flow method (Bjørnestad, 2021). We think the discussion will increase in the coming years and that this is a pressing, important and relevant topic.

In the following subchapters, we will present four different methods and solutions. Some solutions are already discussed publicly, but we have added our own thoughts and data. Other solutions are some we have thought of ourselves. The different solutions are:

1) The Cash Flow Method
2) Use the withdrawals from the fund as a percentage of the GDP
3) Lower the percentage of the monetary action rule to 2 percent
4) Cover budget deficits by debt and do not withdraw from the GPFG

1) The Cash Flow Method

This subchapter will discuss research question 2 and hypothesis 2.1.

The Ministry of Finance in Norway has appointed a committee to advise about sustainable fiscal policy in Norway (Regjeringen, 2022). On February 3rd, 2022, its leader Steinar Holden and the rest of the committee presented their conclusions and recommendations (Holden et al., 2022).

The monetary action rule has entailed an in-phasing of petroleum revenues in the economy, where the use of revenue is based on the expected real return of the fund (Holden et al., 2022, p. 10). It has given Norway a significant safety margin since a fall in the value of the GPFG can be filled by future petroleum revenues. But, this safety margin will decrease if future petroleum revenues decrease, which is expected (Holden et al., 2022, p. 5). Therefore, the committee argues that when Norway cannot count on significant future petroleum revenues, using the expected real return from the GPFG will no longer be a prudent rule (Holden et al., 2022, p. 10).

Due to uncertainty, the risk of significant changes in the fund's value, and the lower expected real return, the committee offered their solutions. One of the solutions was the cash flow method, which we will focus on in this subchapter. The cash flow method bases its withdrawals from the fund on an estimated sustainable level of the cash flow to the fund. It is calculated from the interest revenue, rent, and the cash flow from the companies owned by the fund (dividends and repurchase of shares). It would lead to less instability for fiscal policy and smaller fluctuations (Holden et al., 2022, p. 12).

In the committee's opinion, the monetary action rule needs to be adjusted soon, as well as the implementation of it (Holden et al., 2022, p. 13). They argue that when Norway can no longer depend highly on future petroleum revenues, which earlier could compensate for a sharp decline in the fund's value, there is too much risk in using the monetary action rule. One of the risks if the fund's value falls too much is that it can lead to a difficult budget situation. They further argue that as long as the use of fund assets is linked to the fund's value, Norway should use less than the expected real return of the fund (Holden et al., 2022, p. 13).

The adjusted monetary action rule that the committee suggests will have the same objective as the one today. The leading principle should be that Norway uses the fund's return but leaves the principal. In addition, the adjusted rule should give less instability in the policy of spending and less risk of major figure austerity than the current rule provides (Holden et al., 2022, p. 14).

A disadvantage of the current rule is that there is uncertainty about what is a realistic estimate of expected future real returns (Holden et al., 2022, p. 13). A rule of action where Norway withdrawals a sustainable level of the fund's cash flow, would be a more stable guideline for the usage of the fund. The cash flow is more stable than the market value and less volatile than the market value (Holden et al., 2022, p. 14).

The cash flow revenue has been around NOK 200-240 billion in the last few years, while the fund's value has varied more (Bjørnestad, 2022). The cash flow method would be less vulnerable to changes in market values, such as a change in investors' return requirements. This can reduce the risk of a sharp fall in the fund's value, causing fiscal policy problems (Holden et al., 2022, p. 15). Arguments for adjusting to the cash flow method is that when having the cash flow method, the usage of petroleum revenue will be less than what Norway uses today (Bjørnestad, 2021). The lower withdrawals would help guard against any possible future value fluctuations of the fund. That could help provide a more stable level of withdrawals and be less dependent on the fund's value.

But, the cash flow method can pose a challenge in that it is difficult to assess a long-term and sustainable level that should form the basis for withdrawal of funds. Cash flows can fall a lot if there are major events in the world economy or a global economic weakening. Therefore, there must be detailed estimates of how the cash flow can change in the future. An important factor is also how an adjusted rule could affect the investment strategy of the GPFG (Holden et al., 2022, pp. 14-15).

See table 12 in the Appendix to see how we made figure 12 below. If we collect the OABDs with the cash flows and the allowed withdrawal each year from the monetary action rule, we get this graph:

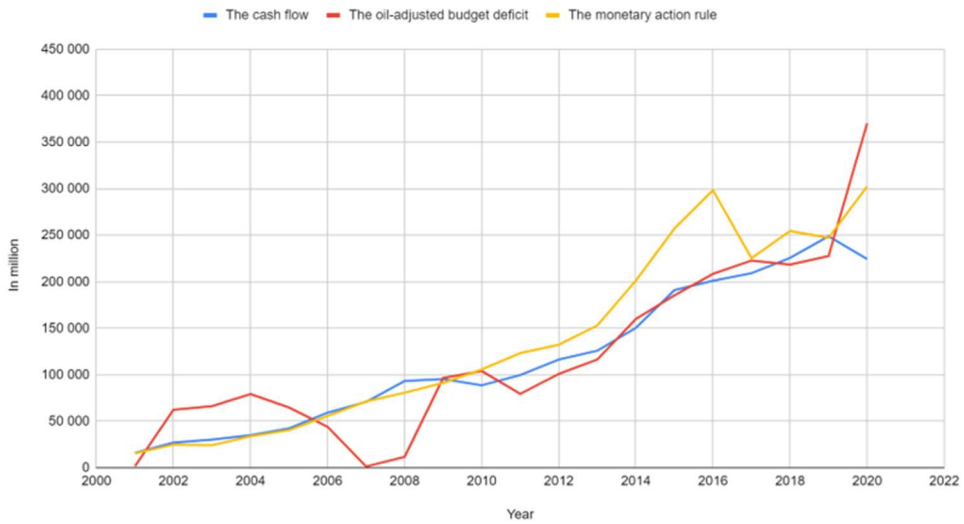

Figure 12: The cash flows (blue line), the OABD (red line) and the monetary action rule (yellow line)

Figure 12 shows the cash flows (blue line) and the withdrawal from the GPFG according to the monetary action rule (yellow line). The two lines follow the same pattern and are highly correlated. The allowed withdrawals have been greater than the cash flow since 2009. The difference between the monetary action rule and the cash flow was relatively low until the oil crisis in 2014. The drop in the yellow line in 2017 corresponds to the adjusted monetary action rule of 3 percent.

Since 2009, the difference between the cash flow (blue line) and the oil-adjusted budget deficit (red line) has been quite low, except for 2020. Since they correlate, we believe the cash flow method would be a good instrument for withdrawals since the withdrawal will be less than 3 percent of the value of the GPFG as of 01.01.XX. When using the cash flow method, less money is withdrawn from the fund, making the fund more sustainable in the long term.

The figure above shows that the cash flow has stabilized around the yearly allowed withdrawals from the GPFG, making them compatible or replaceable. We believe the method also could negate any political pressure from attempting greater use of the fund. It could also negate any political attempts to thwart the reversal of the large withdrawals from the fund, which have occurred in recent years.

Figure 12 tells us that the withdrawal from the fund (red line) has been lower than what is allowed by the monetary action rule (yellow). This argues that it would be a more efficient and optimal method. The only time the withdrawal has been greater than the allowed proportion was in the early years of the monetary action rule and when Covid-19 hit the world in 2020.

The cash flow is not directly affected by the fund's total value, making the method more independent of the fund's value. The cash flow consists of interest revenue, dividend payments, repurchase of shares, stock swaps, interest rate swaps and futures, rental revenue, and infrastructure investments (Holden et al., 2022, p. 12).

The cash flow method would cap the withdrawal at a lower level than today, which would be a more sustainable fund and potentially better for future generations. In addition, the principal of the fund would be kept untouched.

A positive consequence of the cash flow method is that it would limit political influence from excessive use of the fund. The politicians could not use more than what comes in and, on average, a lower level than what is allowed to use today. See figure 12 above.

The cash flow method would be a more stable guideline for withdrawals from the GPFG since the cash flows are shown to be more stable than stocks and bonds (Holden et al., 2022, p. 12). In addition, withdrawals based on a sustainable level of the cash flow will provide smaller fluctuations (Holden et al., 2022, p. 12), making the allowed withdrawal to cover budget deficits more predictable.

Although the cash flow method is close to the actual withdrawals from the fund today, this might not be the case in the future. One only has to look at the difference between the cash flow and the withdrawal in 2020 due to the Covid-19 situation.

It is not illogical to assume that there would be some implications if Norway changed its monetary action rule to the cash flow method. It could result in reductions in budgets for both the government at the national level and within the different parties at the municipal and county levels.

There should be a possible transition period as the difference between the cash flows and the OABDs has grown in the last two years. That could argue for greater resistance to change, especially the longer the differences persist. In addition, we believe there should be an analysis of how the reduction in available withdrawals could affect the economy without any in-phasing periods.

A negative consequence of the new method could be the resistance from the different actors within the Norwegian society, both politically and economically. They may have grown dependent on the yearly withdrawals, and it could lead to insecurity and nervousness.

Another challenge this method poses is that the cash flows can fall significantly if there are major negative events in the world economy (Holden et al., 2022, p. 14). There must be detailed estimates on how the cash flow can change and how to secure it, if possible (Holden et al., 2022, p. 12).

A summary of the positive consequences of this solution:

- The cash flow is not directly affected by the fund's total value, making the method independent of the fund.
- It is highly correlated with the OABDs, which is below what is allowed to withdraw due to the monetary action rule. See figure 12. It argues that the cash flow is a better solution than the current monetary action rule.
- The cash flow method would limit political influence from excessive use of the fund.
- It would be a more stable guideline for withdrawals from the GPFG because the cash flows are shown to be more stable than the value of stocks and bonds (Holden et al., 2022, p. 12). They are less volatile than stocks, making the allowed withdrawal to cover budget deficits, more predictable (Holden et al., 2022, p. 12).
- If the cash flow method is implemented, the principal will be untouched, which is more sustainable for future generations. That is because the usage to cover the budget deficit would match the revenue from the cash flows.

A summary of the negative consequences of this solution:

- The cash flows in the future might not be highly correlated with the future OABDs.
- The method may reduce the government's budgets at a national level and within the different parties at municipal and county levels. It could lead to resistance from different parties within the Norwegian society. One can also speculate that various parties have grown dependent on the yearly withdrawals, leading to insecurity and nervousness.
- The cash flows can fall significantly due to major events in the world economy (Holden et al., 2022, p. 14).

Answer to our hypothesis:

Based on the arguments made in this section and a weighting of the positive and negative consequences, we believe hypothesis 2.1 is correct. We believe that the cash flow method is better for covering budget deficits than the current monetary action rule.

2) Use withdrawals from the GPFG as a fixed percentage of the GDP

This subchapter will discuss research question 2 and hypothesis 2.2.

To answer our research questions, we analyzed the GDP of Norway against the SOABD in the period between 2001 and 2020. To investigate any patterns in the relationship between the two parameters, we found the SOABD as a percent of the GDP. We found these numbers in the national budget for 2022 (Meld. St. 1. (2021-2022), p. 61). See Table 14 in the Appendix.

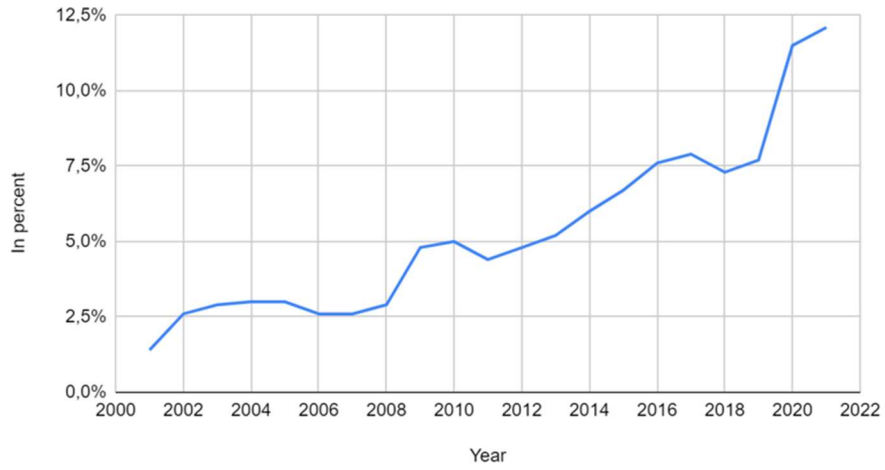

Figure 13: The SOABD as a percentage of the GDP from 2001 to 2021

Figure 13 shows an increasing trend and rate of the SOABD against the GDP. It was under 5 percent of the GDP until 2008 and 2009. After this period, there was a significant increase in the SOABD compared to the GDP rate. The percentage rose to 7,8 before implementing the revised monetary action rule in 2016/2017. There was a slight decrease after the decreased monetary action rule, but this was short-lived. The last three years showed significant increases in the rate from 7,3 percent in 2018 to 12,1 percent in 2021. The two previous years have been exceptional due to Covid-19.

The pattern in figure 13 supports our premise that the SOABD against the GDP was not perceived as a problem until it rose above the 5 percent level. Once the percentage went above this amount, it rose sharply, which may be part of the reasoning behind revising the monetary action rule. Figure 13 shows how dependent and sensitive Norway has become to the fund's value.

Based on figure 13 and observations from our data from the analysis, we believe the monetary action rule appeared to work best between 2001 and 2009. The SOABD, shown as a percentage of the GDP, was then kept below 5 percent (NOU 2015: 9, p. 130, figure 7.11). Our suggested solution is to use 5 percent of the yearly GDP as a withdrawal from the fund.

The yearly average of the SOABD is 5,33 percent[10]. Since the 2008/2009 financial crisis, the SOABD as a percentage of the GDP rose but did not fall back to previous levels; see table 14 in the Appendix. Figure 7.14 in NOU 2015: 9 (NOU 2015: 9, p. 134) shows that the continued use of petroleum revenues from the GPFG was around 5 percent of the Norwegian trend GDP (Regjeringen, 2021c).

Background for choosing the GDP method

In 1956, both Robert Solow and T. W. Swan developed, independently, a model to explain long-run economic growth in a given country by looking at capital accumulation, population, and labor growth. Increases in technology were the main driver for production increases (Romer, 2012, p. 22). The main factors that decide a country's production capacity are access to capital, labor, and how effective these resources are used in the economy (Romer, 2012, p. 11). This is shown in the Solow model. It is both technological progress and the ability of an economy to adapt and implement new technologies, which are the key elements in high growth in production activity and therewith the GDP (NOU 2015: 9, p. 223).

A country with considerable revenue from exporting natural resources will be in danger of Dutch disease (NOU 2015: 9, pp. 74-75). The government must try and ensure this is avoided. But, that is no simple task. Dutch disease refers to an economic phenomenon that affects countries with large amounts of tradable commodities, i.e., oil and gas (NOU 2015: 9, pp. 74-75). In Norway's case, the in-phasing of too much petroleum revenues can result in the building of industries and sectors that are unable to continue when the rate of in-phasing of petroleum revenues declines. This could increase sheltered industries and sectors. In addition, it could lead to a movement of resources away from open markets and competitive industries and sectors (NOU 2015: 9, p. 41).

The conclusion from Thøgersen and his committee is that Norway has succeeded to a large degree with the in-phasing of petroleum revenues into the economy (NOU 2015: 9, p. 230). Nonetheless, the committee recommended decreasing the monetary action rule to 3 percent. The in-phasing into the Norwegian economy had gone quicker than was anticipated (NOU 2015: 9, p. 96).

[10] 112 percent / 21 years = 5,3 percent where 112 is the accumulated yearly withdrawal from the GPFG as a percentage of the GDP

The GDP method

The method proposes that withdrawals from the fund should directly be linked to a percentage of the GDP. The GDP has to develop and increase for increases in withdrawals. Therefore, we believe it would be in the government's vested interest to invest in projects which give a return that helps improve and increase production capacity and value creation.

Norway has the largest public sector amongst selected OECD[11] countries (Meld. St. 1. (2020-2021), p. 76), with 60 percent of public expenses as a percentage of the GDP. The continued dependence on the GPFG has contributed to Norway having large and expensive public services. Other OECD countries have decreased their percentages in recent years (Meld. St. 1. (2020-2021), p. 76).

Many factors decide the growth rate of production and the GDP. The efficient use of resources is crucial (NOU 2015: 9, p. 223). It is perhaps not the most effective use of labor when the public sector accounts for such a large part of the GDP. Large-scale fiscal structural reforms were performed in the 1990s, which became the catalyst for increases in the GDP (NOU 2015: 9, p. 224).

The report by Thøgersen noted that the in-phasing of petroleum revenue has been relatively successful. Nevertheless, the resource usage in public spending on projects designed to increase production ability and the GDP, could have been more effective (NOU 2015: 9, p. 230).

Norway is a small country with a population that we assume is unlikely to grow substantially over the coming years. Limiting the withdrawals to the GDP could result in a large amount of potential usage of the GPFG going to waste.

Norway is one of the most technologically advanced countries, ranking 15 out of 78 countries (World Population Review, n.d.). Therefore, we believe it is not illogical to assume Norway would be able to continue to grow its GDP.

Total withdrawals from the GPFG are NOK 2 834,5 billion (see table 2 in the Appendix). In contrast, total withdrawals according to the yearly GDP would yield NOK 2 298,7 billion (see table 14 in the Appendix). Therefore, the solution we propose would entail lesser withdrawals

[11] The Organization for Economic Co-operation and Development (OECD, n.d.)

from the GPFG. It could cause friction and resistance from different actors in society. We submit that the monetary action rule has become unfit for its purpose. It is a matter of which solution would be a new way forward for Norway.

We further believe that if withdrawals are linked to the GDP, withdrawals could be more explicitly used to develop Norway's GDP. This focus can be until the oil and gas reserves are exhausted, which is calculated to be around 2050 (Meld. St. 1. (2021-2022), p. 38).

Table 14 in the Appendix shows that the GDP changes each year. Therefore, a negative consequence may be that it is difficult for the government to maintain a steady rate of withdrawals from the GPFG. We believe the negative consequence can be solved if withdrawals are linked to the potential GDP, which removes impulses from petroleum revenues due to increases in economic cycles seen in the actual GDP (NOU 2015: 9 p. 113).

A positive consequence of this solution could be a mandated specific long-term strategy to grow the GDP. To increase withdrawals, the GDP would have to increase. This could not be affected or corrupted by politicians' short-term targets or gains.

A withdrawal mandate based upon the GDP could also be subject to artificially trying to hold a high false GDP to ensure greater withdrawals from the fund. For example, we believe Norway could maintain a high GDP by keeping or increasing its public sector. But, we believe this strategy would result in limited growth potential for the GDP since there would be no innovation and integration of new technology.

A negative consequence of such a scenario is that growth could be limited. Therefore, the above scenario might not work in the long term. Compared to when it is mandated on how the funds should be used (without specifying specific projects), there could be criteria that could be evaluated to ensure optimal and efficient usage of the fund. Limiting the rate of in-pashing in the economy can be a sudden and dramatic change for the government's fiscal politics. If it is poorly managed, or if projects do not succeed in increasing the GDP, it can cause long-term damage to the economy through hysteresis. It could, for example, be an increase in long-term unemployment (Carlin & Soskice, 2015, p. 571).

A summary of the positive consequences of this solution:

- By having withdrawals based on the GDP, the government's vested interest is to invest in projects to help improve and increase production capacity and value creation. It could lead to withdrawals being more explicitly used to develop Norway's GDP.
- It could help provide a clear mandate that funds are to be used primarily to increase or the potential ability to grow the GDP. This might be a catalyst for change or other structural reforms free from financial politics.
- It frees and separates the withdrawals from the GPFG and current fiscal policy.
- A specific long-term strategy to grow the GDP could benefit the Norwegian economy. If Norway were to increase withdrawals, there would first have to be an increase in the GDP.
- A 5 percent withdrawal limit based on the GDP would result in significantly lower withdrawals than today; see table 14 in the Appendix. Hence, the solution would be more sustainable, keeping a larger fund for future generations.

A summary of the negative consequences of this solution:

- Lower withdrawals from the GPFG could cause friction and resistance from different actors in society. If the change is too concerning for the status quo today, it may not be able to be implemented due to political resistance.
- The population of Norway might be unlikely to grow substantially over the coming years. When limiting the withdrawals to the GDP, significant potential usage of the GPFG could be lost.
- Vested parties might attempt to maintain a high or false GDP artificially. It could result in wasting funds or inefficient usage of withdrawals.
- There could be limited further growth potential for the GDP since there would be no (or negligible) innovation.
- It does not deal with the issue of Norway perhaps suffering from Dutch disease due to the large withdrawals from the GPFG.
- It can cause long-term damage to the Norwegian economy through hysteresis due to difficulties in undertaking large structural reforms (Carlin & Soskice, 2015, p. 571).

Answer to our hypothesis:

The solution provided is one we believe has not been suggested or discussed previously. Due to the GDP solution being an unknown quantity, this solution is a theoretical argument that we feel is better than the current solution. We believe that connecting withdrawals from the fund directly to Norway's GDP could be feasible. It might provide a better long-term solution than the current monetary action rule.

3) Lower the percentage of the monetary action rule to 2 percent

This subchapter will discuss research question 2 and hypothesis 2.3.

According to our calculations, the GPFG could have been NOK 1 081,58 billion larger in 2022, holding everything else constant, if the withdrawals were two percent from 2002 to 2021. See table 15 in the Appendix.

Norges Bank Investment Management has published forecasts for the GPFG's market value in the coming years. From their data, we calculated the estimated withdrawal from the fund, which is expected to be 2,8 percent (Norges Bank Investment Management, 2022a). The expected withdrawal is NOK 1 262,1 billion from 2022 to 2025. See table 16 in the Appendix. If the withdrawals are being downsized to 2 percent, the withdrawal value in NOK is 901,5 billion. It is possible to save or keep NOK 360,6 billion in the fund by lowering the monetary action rule to 2 percent. See table 16 in the Appendix.

Our data estimates a new value as of 01.01.2023, 2024, and 2025 for the GPFG after a negative shock. If the politicians kept the percentage of 2,8 percent, which is the assumed real return (Norges Bank Investment Management, 2022a), there would be NOK 925,18 billion less in the fund. If the percentage had been 2 percent, the withdrawal would have been NOK 660,84 billion, a difference of NOK 264,34 billion. See table 17 in the Appendix.

If one were to calculate a positive shock, the expected withdrawal would be NOK 1 723,18 billion with 2,8 percent. If the percentage was lowered to 2 percent, the withdrawal would have been NOK 1 230,84 billion, a difference of NOK 492,34 billion. See table 18 in the Appendix. The difference between the expected withdrawal with a positive and negative

shock with withdrawals of 2,8 percent is NOK 789 billion[12]. The difference between the expected withdrawals with a positive and negative shock with withdrawals of 2 percent is NOK 228 billion[13]. These are large numbers and show a significant difference, explaining some part of the sensitivity of the Norwegian economy.

The arguments made in 2016 regarding the monetary action rule are still relevant today. In 2015, when the Thøgersen report was written, a 3 percent return on the shares in the fund was more realistic than four percent (NOU 2015: 9, p. 181). It was argued that the real return of the GPFG could be 3 percent over the next 15 years (NOU 2015: 9, p. 184). It was also anticipated that future real rates would be lowered in the next 10-15 years compared to historical averages (NOU 2015: 9, p. 171).

An argument for lowering the monetary action rule to 2 percent is that long-term rates have decreased in Norway since the Thøgersen report (Norges Bank, n.d.-b). 10-year bond yields have declined in the UK over the last 40 years (Trading Economics, n.d.) and in the US (Macrotrends, n.d.).

When the monetary action rule was created, it was probably never anticipated or calculated that the fund would grow to its current value (Meld. St. 1. (2014-2015), p. 63). The size of allowed withdrawals has grown exponentially compared to withdrawals in the first years. See table 2 in the Appendix for the withdrawals from 2001 until 2021.

Therefore, we believe in limiting future withdrawals to avoid long-term damage to the Norwegian economy. It would be prudent to reduce the monetary action rule to 2 percent. Ever since the monetary action rule was reduced to 3 percent, the withdrawals have been larger than ever before. It is due to the increased value of the GPFG (and Covid-19 in the last two years).

We believe the Norwegian currency being depressed is also an argument for reducing the rule to 2 percent. The lower the Norwegian currency, the larger the value of the GPFG, as it is held in foreign currencies (Meld. St. 24. (2020-2021), p. 20).

[12] NOK 1723,18 billion - NOK 925,18 billion = NOK 789 billion
[13] NOK 492,34 billion - NOK 264,34 billion = NOK 228 billion

The 3 percent rule, with the growing value of the fund, can create Dutch Disease for industries that operate in competitive markets both within and outside of Norway. Dutch Disease is a paradox that can occur when good news in one sector (i.e., the finding of oil and gas) harms the country's economy (Chen, 2021b). That is because the rate of in-phasing of petroleum revenues could be too quick to be efficient for the Norwegian economy.

While the size of the funds withdrawals has grown, the size of the public sector in Norway has stabilized at around 60 percent of the GDP. At the same time, other OECD countries have a decreasing public sector (Meld. St. 1. (2021-2022), p. 144). This can also be a symptom of Dutch Disease in the Norwegian economy.

A consequence of Dutch disease can be that as revenues increase in a growing sector, the nation's currency will appreciate. It would be due to the increased purchase of the nation's currency (export). This leads to an increase in the price of the nation's other exported goods, and imported goods become cheaper. Therefore, those sectors become less competitive ("Dutch disease," 2022).

The size of the fund has grown to a value much greater than first anticipated or calculated (Meld. St. 1. (2014-2015), p. 63). But, it can not be expected that the size of the fund will continue to grow each year or have positive annual returns. Therefore, it would be prudent to reduce the size of withdrawals while the fund has positive returns to avoid erosion of the principal.

A summary of the positive consequences of this solution:

- A more significant portion could be saved for future generations by lowering the rule to 2 percent. The Norwegian economy could also avoid long-term damages and limit the probability of Dutch disease.
- Limiting the withdrawals to 2 percent would decrease and limit the available withdrawal. This could lead to, for example, the public sector undertaking necessary restructuring to become more competitive.
- We believe the anticipated value of the fund will grow at a slower rate in the future. It is positive to reduce the size of the withdrawals to avoid erosion of the principal of the GPFG.

- A lowered rule could limit or negate political willingness to larger withdrawals from the fund. The accumulated value of the fund could increase due to lower withdrawals, which would give greater flexibility in the use of the fund later, and to future generations.
- The rule has been lowered once before, making the change easier for the politicians.

A summary of the negative consequences of this solution:

- Politicians are used to large withdrawals, so 2 percent would represent a substantial change. If Norway were to have a 2 percent oil-adjusted budget deficit from 2001 to 2021, the difference compared to actual withdrawals would be NOK 1 081,5 billion.
- Where would the government get money if they are not being withdrawn from the GPFG? Larger taxes? Fewer expenses? It could be hard for the economy to have, on average, NOK 51,5 billion[14] less each year.

Answer to our hypothesis

Based on the arguments made in this section and a weighting of the positive and negative consequences, we believe hypothesis 2.3 is correct. We believe the lowered monetary action rule to 2 percent is a better solution than the current monetary action rule.

4) Cover budget deficits by debt and do not withdraw from the GPFG

This subchapter will discuss research question 2 and hypothesis 2.4.

Norway has the GPFG, which means the government does not need to borrow funds. But, the government borrows to fund government lending schemes, cover maturing existing debt, and ensure that the government has sufficient cash reserves (Norges Bank, 2022a). Another reason for government borrowing is to keep a well-functioning financial market (Norges Bank, 2022a).

[14] NOK 1 081,584 billion / 21 years = NOK 51,5 billion. NOK 1 081,5 billion is the added value the GPFG could have had if the monetary action rule had been 2 percent from 2001 until 2021.

The Norwegian government can borrow at a low-interest rate since it has a high credit rating (Norges Bank, 2022a). Therefore, the yield on the securities to the Norwegian government is considered risk-free (Norges Bank, 2022a).

As of December 31st, 2021, the Norwegian government debt was NOK 522 billion. It was divided into NOK 466 billion in government bonds and NOK 56 billion in Treasury bills (Norges Bank, 2022b, p. 10). Today, yearly budget deficits are covered by withdrawals from the GPFG and not by debt (Regjeringen, 2021b).

If the Norwegian government were to finance their state budget with loans, and not by withdrawals from the GPFG, the value of the GPFG could have been NOK 5 213,32 billion greater than today, keeping all else constant. See table 19 in the Appendix.

The rule of "Statens Pensjonsfond" § 7 (2) (Statens pensjonsfond-loven, 2005, § 7 - 2) states that the State is not supposed to loan money to finance expenditures over the state budget as long as there are funds in the GPFG. § 7 (3) says that the rule in (2) should not be an obstacle for temporary loans in extraordinary situations. Examples are when the State has specific liquidity needs, or withdrawals from the fund would be highly disadvantageous. For instance, when Covid-19 hit Norway in 2020, Norway could have raised necessary funds from bond markets, even though there was no shortage of funds in the GPFG.

As of March 7th, 2022, the value of the GPFG was NOK 11 400 billion (Norges Bank Investment Management, n.d.-c), but the value could have been 11 400 billion + 5 213,32 billion, which is NOK 16 613,32 billion, as shown by our withdrawal redepositing analysis.

To redepositing the withdrawals into the fund, the withdrawal amount today for each year was calculated. From a message to the Norwegian parliament in 2021 (Meld. St. 24. (2020-2021), p. 163), we got the numbers to collect the nominal return for the GPFG for each year. We calculated the withdrawal value that year and multiplied it by the nominal return for each year, leading up to the final year, 2020. The withdrawals' nominal return and new value were completed on a compound basis. The accumulated total value of the withdrawal each year was then shown as 2021, with over NOK 5 213,32 billion. See table 19 in the Appendix. The total

actual value of the withdrawals[15] from 2001 to 2020 is NOK 2 421,69 billion[16]. See table 2 in the Appendix.

The value in 2021 for the withdrawal in 2002 is NOK 233,38 billion. It was calculated by the withdrawal of NOK 62,4 billion in 2002, multiplied by the return of the GPFG that year, which was -19,1 percent. Further, it was multiplied by the return of the GPFG for each year until 2020, which gave us NOK 233,38 billion[17]. The same method was used every year until 2020. See table 19 in the Appendix.

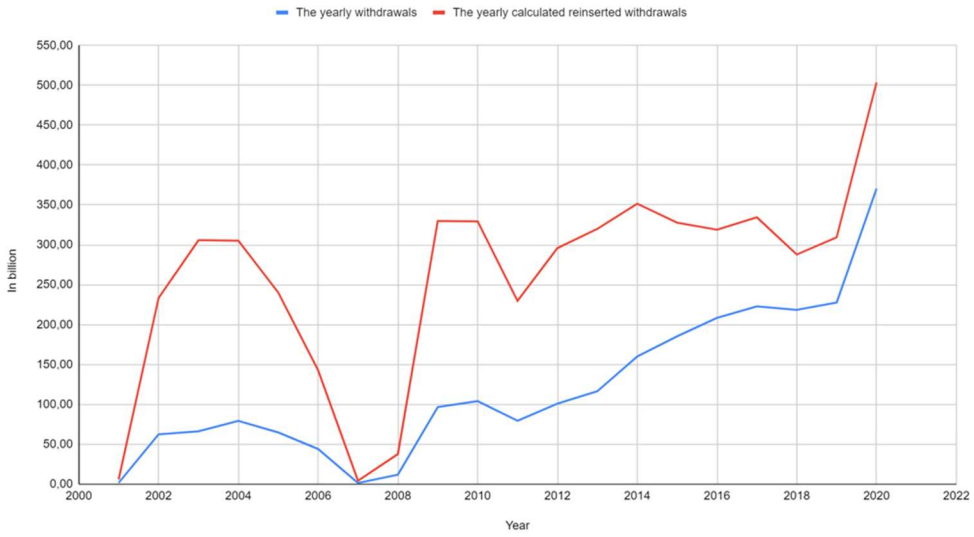

Figure 14: Actual withdrawals from the fund (blue line), compared to the yearly calculated reinserted withdrawals (red line) between 2001 and 2020. See table 19 in the Appendix for the value each year that accumulates to NOK 5 213,32 billion, which gives the red line.

Figure 14 shows the fund's yearly withdrawals (blue line), reinserted with their nominal return for each year (red line). The two lines follow the same pattern, but the yearly calculated reinserted withdrawals (red line) are much larger than the actual annual withdrawals (blue line). This is due to significant nominal returns on the fund. Figure 14 shows how much greater value the withdrawals would be if they never were withdrawn from the GPFG.

[15] Which corresponds to the OABDs
[16] See table 2 minus the withdrawal in 2021. NOK 2834,49 billion - NOK 412,8 billion = NOK 2421,69 billion
[17] The formula for 2002: 62,4 * (1+(-0.191)) * (1+(0.1996)) * (1+(0.0393)) * … * (1+(0.2201) * (1+(0.1141) = NOK 233,38 billion

Borrow instead of completing withdrawals from the GPFG

We will now discuss the economic consequences of borrowing money (issuing bonds) to cover budget deficits rather than withdrawing from the fund. To calculate our estimated interest paid in this subchapter, we used the interest rates for 3, 5, and 10 years on government bonds given by the Central Bank of Norway (Norges Bank, n.d.-b).

If Norway had covered its budget deficit from 2001 until 2020 by government debt with a 10-year interest rate, the total sum paid in interest costs would be NOK 452,3 billion. With a 5-year interest rate, the entire sum would be NOK 317,08 billion. Finally, with a 3-year interest rate, the total sum would be NOK 254 billion. See table 1 below for the 10-year interest rate, and table 21 and table 22 in the Appendix for the 5- and 3-year interest rates.

The annual average interest rate has changed every year (Norges Bank, n.d.-b). We put each year's interest rate into our dataset. For example, for the 10-year interest rate: the 10-year annual average interest rate in 2001 was 6,24 percent, while it was 6,38 percent in 2002. By 2020, it was 0,82 percent. To estimate the hypothetical interest costs paid in billions, we multiplied the actual withdrawal from the GPFG by the interest rate that year. For 2001, it is NOK 0,1 billion[18]. In other words, the loan of NOK 1,64 billion in 2001 would lead to an annual interest payment of NOK 0,1 billion from 2001 until 2010 (ten years). See table 1.

In 2011, the bond matured, and the debt must be repaid, or the government could issue new bonds. The bonds could be issued at an interest rate of 3,12 percent, the annual average 10-year interest rate (Norges Bank, n.d.-b). From 2011 until 2020, the interest costs would be NOK 0,05 billion[19]. The total interest costs for the budget deficit in 2001 would be NOK 1,54 billion[20]. It is calculated by adding all of the annual interest costs together. See table 1 below.

The same method is used for every subsequent year. For example, in 2002, the oil-adjusted budget deficit was NOK 62,4 billion. Bonds could have covered it at an interest rate of 6,38 percent from 2002 until 2011. In 2012, the interest rate was 2,1 percent, and the total interest

[18] Withdrawal of NOK 1,64 billion * an interest rate of 6,24 percent = NOK 0,1 billion
[19] Withdrawal of NOK 1,64 billion * an interest rate of 3,12 percent = 0,0511
[20] 10 years with an interest cost of NOK 0,1 billion and 10 years with an interest cost of NOK 0,05 billion. (10*0,1) + (10*0,05) = NOK 1,54 billion

cost for 19 years would be NOK 54,3 billion. When adding together the sum paid in interest costs for each year, the total would be NOK 452,3 billion. See table 1 below.
See table 1 below for the sum paid in interest costs with a 10-year interest rate. Notice that we have hidden the year 2003 until 2018 for graphical purposes.

10 years			Government bonds with 10 year interest rate				
		Year	2001	2002	2019	2020	Sum paid in interest costs
Year	Withdrawals from GPFG in billions	Yearly interest rate on government bonds, 10 years	6,24%	6,38%	1,49%	0,82%	
2001	1,64	Estimated Interest paid, in billions	0,10	0,10	0,05	0,05	1,54
2002	62,40			3,98	1,61	1,61	54,30
2003	66,15				1,71	1,71	46,99
2004	79,20				2,00	2,00	48,50
2005	64,80				1,02	1,02	30,34
2006	44,00				0,59	0,59	20,83
2007	1,34				0,02	0,02	0,73
2008	11,80				0,22	0,22	5,94
2009	96,56				**1,44**	1,44	41,50
2010	104,00				**3,66**	**0,85**	37,46
2011	79,40				2,48	2,48	24,77
2012	100,90				2,12	2,12	19,07
2013	116,40				3,00	3,00	24,02
2014	160,00				4,03	4,03	28,22
2015	185,30				2,91	2,91	17,46
2016	208,40				2,77	2,77	13,86
2017	222,80				3,65	3,65	14,62
2018	218,50				4,11	4,11	12,32
2019	227,60				3,39	3,39	6,78
2020	370,50					3,04	3,04
Sum withdrawals	2421,69					Sum in billions	452,30

Table 1: The total interest costs with a 10-year interest rate

The same method has been used to estimate the total interest costs with a 5- and 3-year interest rate. With the 5-year interest rate, the interest costs would be NOK 0,1 billion from 2001 until 2005, to cover the budget deficit of 2001, NOK 1,64 billion. From 2006 until 2010, the interest cost would be NOK 0,06 billion each year, since the interest rate changed to 3,9 percent in 2006. From 2011 until 2015, the interest costs annually would be NOK 0,04 billion, due to the interest rate being 2,56 percent in 2011. From 2016 until 2020, the interest costs would be NOK 0,01 billion. The total sum paid in interest costs for the budget deficit of 2001 would be NOK 1,12 billion. The same method is used for the next 19 years of budget deficits. The estimated sum paid in interest costs with an interest rate of 5 years would be NOK 317,08 billion. See table 21 in the Appendix.

With a 3-year interest rate, the interest rate changes every three years. Therefore, the interest costs only stay the same for three years. Due to the interest rate declining significantly over the last few years, the total sum paid in interest costs would be NOK 254 billion for the previous 20 years, much less than the 10-year interest rate. See table 22 in the Appendix.

To conclude the solution regarding borrowing to cover budget deficits, we calculated the value of the GPFG today if we had reinserted the withdrawals and deducted the interest costs.

The value of the GPFG today with a 10 year interest rate would be NOK 16 161,02 billion. It would be NOK 16 296,24 billion and NOK 16 359,32 billion with a 5 and 3-year interest rate, respectively. See the calculations for solution 4 in the Appendix.

When looking at Norway's OABDs, they have increased dramatically since 2001, when it was NOK 1,64 billion. In 2021, it was NOK 412,8 billion. Comparing a debt of NOK 1,64 billion and NOK 412,8 billion with its interest rates, will yield a significant difference. It will, therefore, also cause a large change in the Norwegian economy.

Debt bias is when budget deficits rise during recessions but do not fall sufficiently during boom periods (Carlin & Soskice, 2015, p. 535). If Norway were to cover its budget deficit with debt in a recession period or during challenging times like the Covid-19 situation, it could be hard to adjust to a lower debt when the hard times are over.

In the last couple of years, lending interest rates have been very low, even at 0,12 percent for a 3-year rate. The low rates make it attractive to have debt since it is incredibly cost-effective. The GPFG has increased to new heights and a four-doubling since 2010. See table 1 for the OABDs of the last 20 years.

If all of the deficits were covered by debt, could politicians be tempted to have more debt since it can be considered almost cost-free? Could they be tempted to start new projects since the rates are low? Could this lead to poor judgment and an unsustainable way of the country's governance? What happens the day interest rates are at 10 percent, and the government has agreed to pass a project in the future with debt? Is it possible for Norway to have unsustainable debt in the future?

As we wrote in the theory part, unsustainable debt is not desirable. If Norway were to cover budget deficits with debt, it must ensure that the debt ratio is not growing perpetual. What is essential is that the growth is larger than the interest rate, $g > r$. That would lead to situations that give a desirable and sustainable debt. It would also provide a sustainable fiscal policy for the country.
Political resistance or political short-termism may dominate, resulting in incorrect decisions or solutions regarding how and how much to borrow. Since it costs little to borrow money, it

may cause the government to borrow more than necessary as it is considered very cost-effective.
The solution does not solve the economy's problem of becoming too dependent on sizable withdrawals. They are causing the in-phasing of petroleum revenue into the economy to continue at a long-term rate that can be damaging. The solution does tackle the problem of the sensitivity to swings in the fund's value.

It can be difficult to judge when the optimal timing to repay government debts is. It can occur that debts would need to be repaid at points that coincide with negative returns of the fund, which could mean large capital withdrawals from the fund. Politically, there can be disagreement, which can also cause sub-optimal timing issues.

A summary of the positive consequences of this solution:

- Allows the fund to grow larger and quicker, saving more for future generations.
- The value of the GPFG today would be NOK 16 161,02 billion, compared to NOK 11 400 billion as the value is today, assuming a 10-year interest rate.
- It could also make the GPFG independent of political inference and financial politics. It might lead to greater political pressure to ensure efficient and optimal use of the borrowed funds.
- It has become cheaper to borrow money in the last couple of years. Therefore, the government can borrow cheaply while the fund experiences larger returns.
- Solves the problem of the government being sensitive to sudden large changes in the fund's value.

A summary of the negative consequences of this solution:

- Low-interest rates may increase in the future, causing the debt to be more expensive.
- There is no guarantee that the fund's value will increase in the future, especially at the rate it has been growing.
- Debt bias is when budget deficits rise during recessions but do not fall sufficient enough during boom periods. This is something that can happen to the government debt as well.
- Political resistance could lead to incorrect decisions regarding how much to borrow.
- It does not solve the problem of the damaging in-phasing rate of petroleum revenues into the economy.

- It can be difficult to judge when the optimal timing to repay government debts is.

Answer to our hypothesis:
Based on the arguments made in this section and the weighting of the positive and negative consequences, we believe hypothesis 2.4 is correct. We think the solution would benefit people today and in the future.

Analysis part two: conclusion

In the analysis part two, we presented four different solutions to the, as we see it, outdated monetary action rule. Evidence from various high-profile economists, experts in the field, and discussions in the media have made similar points. The solutions we suggest in solving research question 2, in our opinion, solve research question 1.

The first solution presented is the cash flow method. The yearly cash flows for the fund have been NOK 200-240 billion over the last few years. They highly correlate with the OABDs (Bjørnestad, 2022). In our opinion, and based on different research in this thesis, we think this method would be the most logical replacement for the current rule. Based on both the positive and negative arguments of the solution, we believe hypothesis 2.1 is correct and is better than the current rule.

The second solution present is the GDP method. This method entails that withdrawals from the fund should be linked to 5 percent of the Norwegian GDP. By comparing the 5 percent withdrawals based on the GDP with the OABDs from 2001 to 2021, we get a difference of NOK 535,8 billion (see table 2 and table 14 in the Appendix). The use of the fund could be mandated to invest in projects that would help grow the GDP. In our opinion, this solution would be the hardest to implement. Based on both positive and negative arguments of the method, we believe hypothesis 2.2 is correct, and this suggested solution is better than the current rule.

The third solution is lowering the current rule to 2 percent. We chose to include the 2 percent rule since the rule has been reduced before. It seemed like a natural continuation. If the rule had been 2 percent the last 20 years, the fund's value would be more than NOK 1 000 billion more today. It is possibly the most practical and straightforward solution to implement, as this

was previously done. It could help keep the principal of the fund untouched. Based on both positive and negative arguments of the method, we believe hypothesis 2.3 is correct, and this suggested solution is better than the current rule.

The final solution is to cover the OABDs by loans. Due to the current low interest rates, this is an economically rational solution. If one were to reinsert all of the withdrawals and cover the deficits by loans, the value of the GPFG today could be above NOK 16 000 billion. Therefore, this solution would be best in terms of monetary value as it would lead to the largest value of the GPFG. Based on both positive and negative arguments of the method, we believe hypothesis 2.4 is correct, and this suggested solution is better than the current rule.

In the discussion, we will go more in-depth regarding the merit of these different solutions.

Discussion

We believe this thesis answers our research question about whether the Norwegian economy has become too dependent on the GPFG to cover its budget deficits. We think it is due to the current monetary action rule, and it has become outdated. In our opinion, the current rule worked for ten years, from 2001 to 2010, until the financial crisis. See figure 15 in the Appendix and figure 13 in the analysis part two. The evidence that shows it no longer fits its purpose is the various parameters shown in the first part of the analysis and solutions to the problems. We have presented four feasible alternative solutions to this problem, and we will now discuss our solutions in more depth.

The following part will discuss and summarize why the current monetary action rule is outdated.

In 2001, the petroleum revenue as a percentage of the GPFG was over 40 percent. Today, the percentage is 1 percent. See figure 7. The changes in petroleum prices today have less impact. The changes and uncertainty in stock markets and the market value of the GPFG have gradually taken a more prominent role in the state budget (Meld. St. 1. (2021-2022), pp. 53, 63).

Is it the substantial change of the increase in the fund's value that has caused the current monetary action rule to become outdated? The fund's value is now too large compared to the size of the economy for such a rule to be the guideline for reasonable usage. This allows the petroleum revenues to be integrated into the economy at a non-sustainable long-term rate. That could cause Dutch disease and damage to the economy.

The percentage of total budgetary expenses accounts for almost 26 percent of today's total budget. The size of the OABD has grown exponentially (see table 4 in the Appendix). When comparing the percentages from previous years and today, we believe it argues that the current monetary action rule is outdated. It is, in our opinion, unsustainable that the withdrawals, which have an increasing trend, account for greater percentages of the state budget. If the fund were to have a stock market crash of 50 percent, it would lead to a large difference in available funds to cover the budget deficit.

The last two years have given us record withdrawals. However, the total withdrawals from the fund are still within the 3 percent rule as accumulated withdrawals over the past 21 years[21]. This provides support for an outdated rule as well.

The size of the fluctuations in the withdrawals in the event of a 50 percent stock market crash indicates that the rule no longer serves its purpose. The same argument can be made for large changes in the strength of the Norwegian currency.

The Thøgersen report noted that the integration of the petroleum revenue had gone quicker than expected in their arguments as to why the monetary action rule needed to be amended (NOU 2015: 9, p. 96). There was an attempt at an adjustment in 2016/2017. Our data shows that the amount of money integrated into the economy over the last three years demonstrates that this did not work. Even though Covid-19 has increased the OABDs in the previous two years, the fund's value has never been at a larger level.

The withdrawals account for a too-large portion of the economy for them to be sustainable in the long term. In the report from Thøgersen, it was highlighted that politicians' lack of discipline leads to bad decisions (NOU 2015: 9, p. 234). Therefore, you can not expect

[21] In order to calculate the correct total percentage use of the fund, all the values as of 31.12.XX was added together, which are NOK 99 903 billion. The sum of the total OABDs for the last 21 years is NOK 2 834,49 billion. The withdrawals were divided by the values of the fund as of 31.12.XX, and it gave an accumulated total value of 2,8 percent.

politicians to be able to make good long-term economic decisions on important matters. This argument was also drawn by Romer (Romer, 2012, pp. 605-606), where one reason for budget deficits is that politicians choose short-termism for their goals.

A possible consequence of politicians' poor ability to make sound economic decisions can be Dutch disease. The yearly withdrawals have increased steadily, resulting in the economy becoming too dependent on them. One can argue that Norway, to some degree, suffers from Dutch disease. The significant increase in demand from the petroleum sector was met primarily by large-scale immigration. However, this has also driven up wages in other sectors. In addition, large-scale immigration also resulted in a need for investment in the public sector, i.e., schools and hospitals (NOU 2015: 9, pp. 113-114).

The increases in withdrawals from 2001 to 2009 match the increases in population due to the immigration into the petroleum sector (NOU 2015: 9, p. 97, figure 6.4 C & D). It was then necessary to grow the public sector to keep the same level and quality of public services as before (NOU 2015: 9, p. 114). This was perhaps fine when the monetary action rule worked from 2001 to 2009. However, in growing the public sector during this period, efficiency, and change were never prioritized by politicians. This, combined with a fund that grew exponentially, meant no reform was necessary.

The finance and oil crisis resulted in a public sector that normally would be forced to reform and change. A non-effective use of labor and resources would normally not be able to continue. The withdrawals from the GPFG masked and helped it continue and stabilize. This is demonstrated in the permanent increases in the OABDs after each crisis (see table 2 in the Appendix). The monetary rule combined with a fund that grew larger than anticipated inadvertently contributed to Norway suffering from Dutch disease.

When the monetary action rule was introduced, the various sources show that the government never anticipated the value of the GPFG to grow so large (Meld. St. 1. (2014-2015), p. 63). In the 2001 report to the parliament (Meld. St. 29. (2000-2001), pp. 8-9), the rule was calculated to be used for ten years. It is logical to assume it was to be revised after this. The report anticipated that the value of the GPFG may grow to over 120 percent of- and account for 5 percent of GDP in 2010 (Meld. St. 29. (2000-2001), p. 10, figure 2.2). The report's calculations are based until 2010, which interestingly is the period we have concluded that the monetary action rule worked well for the Norwegian state and economy.

The monetary action rule has become more ineffective because the fund's value is larger than what the rule was designed to accommodate. As a result, the Norwegian economy has become too dependent on the GPFG. Therefore, we believe our alternatives offer a better solution. The next part of the discussion is our suggested solutions for replacing the current monetary action rule.

The cash flow method is a viable solution to keep the current levels of withdrawals. Our data shows that the cash flow revenues have correlated highly with the historical OABDs. Initially, this solution seems like a good alternative.

In our opinion, the solution will work well and could have worked well. That is except for the last two years due to Covid-19. If this method was used, a decrease in government spending could be necessary. That is because the previous year's level of withdrawals is far above the cash flows received into the fund. See table 12 in the Appendix. For 2019 and earlier, the difference is not large compared to 2020.

The reasoning for this method is that revenue from the petroleum sector will decrease in the future. In addition, cash flows are less volatile and fluctuate less to the fund's market value. It would help preserve the principal of the fund. On the other hand, the cash flows can fall due to significant events in the world economy. Future cash flows may not be as highly correlated to the future OABD as it has previously.

Implementing the cash flow solution could require adjustments by the government to be achievable. We believe the investment strategy of the GPFG could need to be adjusted (NOU 2016: 20, p. 11). It can be challenging to make changes in the overall investment strategy, and it might take years to build expertise. We cannot assume that a shift in strategy to the cash flow method will be successful.

Suppose the problem of the increasing withdrawals is primarily due to the size of the public sector. In that case, it can take years to reform and reduce the integration rate of petroleum revenues to a sustainable level. There is no guarantee that different parts of the public sector will be open to reform. Instead, the burden of reform and reduction in spending could be placed on other sectors. That could potentially damage the potential long-term growth of these sectors and the economy. Has one found something which plugs the gap with the cash flow method? It does not deal with any underlying issues, as the cash flows before 2019 matched the OABD.

The GDP method is linked to the size and growth of Norway's GDP. A benefit of the method is that it could prevent Dutch Disease. That is because both the GDP and the potential GDP would have to grow before any increase in withdrawals could be made. That way, it separates the fund and withdrawals from financial policies. It could force politicians to find other solutions to the OABD, which has increased steadily over the last ten years.

A benefit could be a formed mandate to increase the GDP. We believe it would involve different numbers of government departments who are working in unison and could initiate ideas, reforms, and suggestions. These could be evaluated, implemented, and executed to increase the potential and actual GDP. As a positive consequence, there could be little political interference in using the funds, nullifying the problem other countries face. In those countries, this led to increased economic pressure and a weakening cost competitiveness to these economies (NOU 2015: 9, p. 75).

The GDP method could be independent of the fiscal budgetary solution that the government uses today. It argues for a rule that leads to greater savings for future generations, which could help the fund's value continue to grow. The use of the fund could be mandated to invest in projects that would help to increase the GDP over the short and long term.

The solution might give reason to undertake structural fiscal reforms in various markets to be able to grow the GDP. Connecting withdrawals from the fund to the GDP may result in effective new technology integration. Projects could be completed to increase the GDP while the economy has to undertake necessary reforms, i.e., reduce the size of the large public sector to grow the GDP.

Negative aspects could be little innovation, and could cause friction and resistance from different actors in the society. Also, the actors could artificially inflate the GDP to maintain high levels of withdrawals. This solution might be the hardest to implement.

Norway has successfully integrated petroleum revenues into the economy (NOU 2015: 9, p. 230). The withdrawals have helped Norway keep unemployment at a low level (NOU 2015: 9, p. 31), which has helped increase the GDP.

In helping maintain full employment, the withdrawals have helped prevent hysteresis in the labor market. Hysteresis was shown in different countries from 2001 to 2011 (Carlin &

Soskice, 2015, p. 576). The GPFG and the monetary action rule have helped Norway keep a stable economic development and growth (NOU 2015: 9, p. 222).

The SOABD compared as a percentage of the GDP has increased to 12 percent; see table 14 in the Appendix. Since 2001, the GDP has increased by around NOK 2 000 billion, but budgetary expenses have increased by NOK 1 000 billion; see table 4 in the Appendix. The increase in the percentage of the budgetary deficit compared to the GDP indicates that the rule is outdated.

When petroleum reserves are expected to be exhausted in 2050 (Meld. St. 1. (2021-2022), p. 38), the GDP method could be changed. It means the fund has almost thirty years to try and grow the Norwegian GDP. After 2050, withdrawals can be based on the fund's actual returns as the current monetary action rule or another method.

The 2 percent method is a solution that would decrease yearly withdrawals. For 2022 and outwards, the government is looking to reduce withdrawals from the fund to 2,8 percent of the value (Norges Bank Investment Management, 2022a). Since 2,8 percent is less than 3 percent, the government sees a problem with the current rule. They have indicated they wish to reduce future withdrawals to less than 3 percent (Meld. St. 1. (2021-2022), p. 6).

The monetary action rule has been lowered once before, and therefore, this might be the easiest solution to implement. Since the GPFG has followed a constantly increasing trend, the method appears to be a short-term solution. That is because it could be postponing the problem of the size of yearly withdrawals and the economy's dependence on the GPFG.

From the government's possible value prognosis of the fund, it can grow to as large as around NOK 22 000 billion (Meld. St. 1. (2021-2022), p. 76, figure 3.11B**)**. Two percent of that is NOK 440 billion, which is more significant than the amount withdrawn during the Covid-19 pandemic. The two percent rule keeps a more considerable amount in the fund, but this will not be the case if the fund continues to grow at its pace today. Could this simply be trying to adjust a rule that no longer works?

Changes in government budgetary fiscal spending can create unforeseen problems and resistance within government and opposition parties. The difference in actual withdrawals and the 2 percent method in the last two years would be NOK 168,78 billion and NOK 194,66 billion. See table 15 in the Appendix.

It is logical to assume that the economy has become accustomed to high levels of withdrawals, and a further revision of the rule may cause unforeseen problems. A risk with the method is that it might only work for a short time. If the fund continued to increase in value, the method could soon be outdated. The last revision only appeared to work for a short period. That is because current petroleum revenues integrated into the economy are greater than before the previous amendment.

It is not illogical to assume that the current withdrawals are already at unsustainable levels. That is because the government has indicated that it wishes to reduce these. The government might be aware that it could create problems in the short run if there were to be a sudden reduction from 3 percent to 2 percent.

The debt method is a solution to cover yearly budget deficits by debt and not withdrawing from the GPFG. A valid reason for this method is the current low rates paid on government bonds and that Norway has a high credit rating. If one reinserted all of the withdrawals and covered the yearly deficits by issuing debt, the value of the GPFG could be above NOK 16 000 billion. In terms of monetary value, this solution would lead to the highest value of the GPFG.

There is a risk of the low rates increasing in the future and the risk of debt bias. It is proven that governments create debt to maintain economic stability in times of economic downturn. It is also proven not to make adjustments to repay debt or change taxation to recover the funds during economic up-turns. Therefore, many countries experience an ever-increasing level of debt (Carlin & Soskice, 2015, p. 535).

The debt solution may also create the impetus for change and hold the government more accountable for how funds are being used. This could be possible by ensuring the government invests in projects calculated to give positive returns.

The debt method may increase the strength of the Norwegian financial markets and strengthen the Norwegian currency. That is because the financial market could grow and be larger if Norway were to issue both international and national bonds. It may create a more robust financial market for Norway. Perhaps it could lead to more financial instrument trading partners. Larger transaction amounts and volumes of the Norwegian currency could create a more stable and less volatile currency.

The method would not eliminate the political pressures faced in using withdrawals. Still, it is logical to assume that a government that borrows money is held more accountable than one which transfers money from savings. The method does not deal with why the economy has become too dependent on the withdrawals or why the withdrawals have grown to their current levels.

Debt repayment could be made at points in time which could be beneficial to the long-term growth of the GPFG. The lending method can give greater flexibility in how and when withdrawals are made from the GPFG.

If the size of the fund were to diminish through financial shocks, it could cause negative returns over a more extended period. A negative consequence is that it could lead to erosion of the principal of GPFG. An economy needs stability to avoid damage. Therefore, withdrawals could be made, ensuring economic stability but reducing the fund's value. It could be the start of a continuous process where governments and political parties argue that the short-term financial stability of the country outweighs the need for a long-term investment strategy. Therefore, current generations will not suffer, or longer take regard to the overall long-term goal of the fund.

The GDP and the debt methods could remove the shielding that has kept an inflated public sector. Norway has the largest public sector amongst selected OECD countries (Meld. St. 1. (2020-2021), p. 76). Over time, this is problematic from an economic standpoint because it can reduce the ability for economic growth and innovation (Riekeles, 2017, p. 1).

The cash flow method and the 2 percent method could ensure no need for change in the public sector. That is because the methods allow for withdrawals to be kept at the current levels. Subsequently, these solutions can be seen as variations of the status quo and will not be different enough to create a need for reform in the public sector or other sectors.

The GDP and debt approach could perhaps avoid Dutch Disease in Norway. The GDP approach could avoid this by connecting withdrawals specifically to growing GDP and keeping a fixed percentage of the GDP. If Dutch disease has occurred in Norway, it might slowly improve the negative consequences. It can do that by helping make open market sectors more competitive and reduce overall wages compared to other OECD countries. It can also be done by allowing new technology integration and developing new industries. The

borrowing method could improve overall market efficiency. Government debt might result in them being held to greater scrutiny and evaluation than the current withdrawal method.

As shown in the analysis part one, the available withdrawals decreased significantly with a 50 percent stock market crash. There might be a scenario where the principal is reduced for many years. If this coincides with a negative financial shock, it could lead to political arguments regarding the overall strategy, usage, and goals of the GPFG. In addition, the 50 percent market crash scenario would result in a large budget deficit. Painful and quick reforms may need to be undertaken, creating socio-economic problems for the population.

If there is volatility with the Norwegian currency, the fund's value could be lower or higher measured in the Norwegian currency. This could infer large fluctuations in the available withdrawals, creating uncertainty within the government and impact fiscal spending. It may create political pressure to use more petroleum revenue than what is sustainable for future generations. Our analysis shows that the probability of a sudden appreciation of the Norwegian currency by 35 percent is unlikely.

An example of this is that the GPFG operates with an 8 percent standard deviation in their calculations for changes in the fund's value, with the parameter of the currency exchange rate (Meld. St. 1. (2021-2022), p. 201). The value of the fund and the withdrawals are such that an 8 percent difference in the fund's value will significantly impact available funds to cover the budgetary deficit as of the monetary action rule.

When looking at the Norwegian currency exchange rate from 2002 until 2022 against EUR, the general trend is a depreciation every time there is a crisis. The return to a currency value after any crisis appears to take several years, if it can recover to its previous value at all. This is, in our opinion, something that strengthens our belief that the Norwegian currency will continue to be weak against other currencies. That leads to a further increase in the fund's value measured in NOK.

Conclusion

In conclusion, the Norwegian economy has become too dependent on the size of withdrawals from the GPFG to cover the yearly budget deficits. Therefore, we believe that the answer to the first part of our research question one is yes. We demonstrated this through our sensitivity analysis with a 50 percent stock market crash, currency (de)appreciation, and further analyses with various parameters. They all proved that the withdrawals and integration rate are too large and unsustainable. Further, we looked at how non-dependent Norway is on new petroleum revenues transferred into the GPFG. One of the reasons behind Norway's dependency on the GPFG is the large sums transferred due to the current monetary action rule. Others are the size of the withdrawals as a percentage of budgetary expenses, the GDP, and how the increasing withdrawals are still within the 3 percent monetary action rule.

The second part of our research question involves different possible solutions to the problem proved in our research question. In a summary of these solutions, we believe the solutions are viable alternatives. Solution one about the cash flow method is probably the most logical replacement for the current rule. The second solution about the GDP linked to withdrawals could probably be the hardest to implement. The third solution, reducing the current rule to 2 percent of the fund's value, might be the most practical and easiest to implement. Lastly, the fourth solution with borrowing money to cover the OABDs is the most financially prudent, in our view. Weighing each solution's positive and negative consequences, the positive ones weighed more. That resulted in us recommending all of the solutions compared to the current one and therefore believing all of our hypotheses are correct. We think we have proved beyond a reasonable doubt that all of the solutions are better than the current monetary action rule.

Suggestions for further work

The theme we chose for this master thesis has been challenging and interesting, and we recommend the field to future students. Based on our thesis, suggestions for further work could be to research how low or how far Norway can reduce withdrawals from the fund. However, they should still ensure the integration of the petroleum revenues is kept at a sustainable and non-damaging level for the Norwegian economy.

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Appendix

The Appendix has a lot of different information, tables, and figures used in our thesis. The complete dataset in Excel can be shown upon a request to the authors.

Different information regarding the theory part

The formula for the IS-curve is (Wulfsberg, 2021, p. 19):

$$y = y^* - \alpha_1(i - \pi^e - r^*) + \alpha_2(q - q^*) + z^d$$

Where:

y = it is the logarithm to Y (GDP) (Wulfsberg, 2021, p. 3)

y* = it is the logarithm to Y* (potential GDP) (Wulfsberg, 2021, p. 3)

a1 = a positive parameter (automatic stabilizer) (Wulfsberg, 2021, p. 19)

a2 = a positive parameter (Wulfsberg, 2021, p. 19)

i = nominal key interest rate (Wulfsberg, 2021, p. 3)

π^e = expected inflation (Wulfsberg, 2021, p. 3)

r* = the neutral real interest rate (Wulfsberg, 2021, p. 3)

q = it is the logarithm to the real exchange rate (Wulfsberg, 2021, p. 19)

q* = the equilibrium real exchange rate (Wulfsberg, 2021, p. 19)

z^d = a demand shock (Wulfsberg, 2021, p. 3)

The formula for the Phillips-curve is (Wulfsberg, 2021, p. 19):

$$\pi = \pi^e + \gamma_1(y - y^*) + \gamma_2(q - q^*) + z^s$$

Where:

π = the inflation (Wulfsberg, 2021, p. 3)

π^e = the expected inflation (Wulfsberg, 2021, p. 3)

y1 and y2 = positive parameters (Wulfsberg, 2021, p. 19)

y = the logarithm to Y (GDP) (Wulfsberg, 2021, p. 3)

y* = the logarithm to Y* (potential GDP) (Wulfsberg, 2021, p. 3)

q = the logarithm to the real exchange rate (Wulfsberg, 2021, p. 19)

q* = the equilibrium real exchange rate (Wulfsberg, 2021, p. 19)

z^s = a supply shock, i.e.: increase in prices or the salary level (Wulfsberg, 2021, p. 3)

The formula for the UIP-curve is (Wulfsberg, 2021, p. 20):

$$q = q^e - (i - \pi^e) + (i^f - \pi^{f,e}) + z^f$$

Where:

q = the logarithm to the real exchange rate (Wulfsberg, 2021, p. 19)

q^e = the expected exchange rate (Wulfsberg, 2021, p. 19)

i = nominal key interest rate (Wulfsberg, 2021, p. 3)

π^e = the expected inflation (Wulfsberg, 2021, p. 3)

i^f = the interest rate abroad (Wulfsberg, 2021, p. 19)

π^f,e = expected inflation abroad (Wulfsberg, 2021, p. 19)

z^f = an exchange shock (Wulfsberg, 2021, p. 19)

General information used throughout thesis

	Percent	Billions	Billions	Percent	Billions	Billions
	Monetary action	Value GPFG	Value GPFG	The structural oil-adjusted budget	Structured oil-adjusted budget	Oil-adjusted budget
Year	rule in percent	as of 01.01.XX	as of 31.12.XX	deficit as a % of the GPFG as of 01.01.XX	deficit as of 31.12.XX	deficit as of 31.12.XX
2001	4 %	386,6	619,3		16,80	1,64
2002	4 %	619,3	604,6	5,3%	32,70	62,40
2003	4 %	604,6	847,1	6,5%	39,20	66,15
2004	4 %	847,1	1 011,5	5,1%	43,30	79,20
2005	4 %	1 011,5	1 390,1	4,5%	45,60	64,80
2006	4 %	1 390,1	1 782,8	3,0%	42,20	44,00
2007	4 %	1 782,8	2 018,5	2,5%	44,30	1,34
2008	4 %	2 018,5	2 279,6	2,7%	54,20	11,80
2009	4 %	2 279,6	2 642,0	4,1%	94,20	96,56
2010	4 %	2 642,0	3 080,9	3,9%	102,20	104,00
2011	4 %	3 080,9	3 307,9	3,1%	95,00	79,40
2012	4 %	3 307,9	3 824,5	3,3%	110,50	100,90
2013	4 %	3 824,5	5 032,4	3,3%	125,40	116,40
2014	4 %	5 032,4	6 430,6	3,0%	150,70	160,00
2015	4 %	6 430,6	7 460,8	2,7%	175,90	185,30
2016	4 %	7 460,8	7 509,9	2,8%	206,40	208,40
2017	3 %	7 509,9	8 484,1	3,0%	222,00	222,80
2018	3 %	8 484,1	8 243,4	2,5%	215,00	218,50
2019	3 %	8 243,4	10 086,2	2,9%	235,80	227,60
2020	3 %	10 086,2	10 907,1	3,6%	364,90	370,50
2021	3%	10 907,1	12 340,00	3,6%	397,20	412,80
SUM					2813,5	2 834,49

Table 2: The structured oil-adjusted budget deficit, the oil-adjusted budget deficit and the value of the GPFG as of 01.01.XX and as of 31.12.XX

Table 2 shows the value of the GPFG as of 01.01.XX and as of 31.12.XX, the SOABD and SOABD as a percentage of the value of the GPFG as of 01.01.XX (Meld. St. 1. (2021-2022), p. 61). The OABD is also included (Meld. St. 1. (2021-2022), p. 199).

Petroleum revenues

	Billion	Billion	Percentage
		The value of the	Petroleum income as a
Year	Petroleum income	GPFG as of 31.12.XX	percentage of the value of the GPFG
2001	268,9	619,3	43,4%
2002	185,3	604,6	30,6%
2003	191,2	847,1	22,6%
2004	222,1	1 011,5	22,0%
2005	297	1 390,1	21,4%
2006	376,6	1 782,8	21,1%
2007	337,4	2 018,5	16,7%
2008	437,7	2 279,6	19,2%
2009	304,5	2 642,0	11,5%
2010	296,1	3 080,9	9,6%
2011	372,2	3 307,9	11,3%
2012	421,1	3 824,5	11,0%
2013	378,7	5 032,4	7,5%
2014	347	6 430,6	5,4%
2015	247,2	7 460,8	3,3%
2016	152,6	7 509,9	2,0%
2017	194,4	8 484,1	2,3%
2018	273,5	8 243,4	3,3%
2019	283,2	10 086,2	2,8%
2020	114,7	10 907,1	1,1%
2021	122,3	12 340,00	1,0%

Table 3: The value of the GPFG as of 31.12.XX (Meld. St. 1. (2021-2022), p. 61), the yearly petroleum revenues (see sources below), and the petroleum revenues as a percentage of the value of the GPFG as of 31.12.XX

Sources for the yearly petroleum revenues:

2001: NOK 268,9 billion (Meld. St. 2. (2001-2002), p. 50).

2002: NOK 185,3 billion (Meld. St. 2. (2003-2004), p. 28)

2003: NOK 191,2 billion (Meld. St. 1. (2005-2006), p. 62)

2004: NOK 222,1 billion (Meld. St. 1. (2005-2006), p. 62)

2005: NOK 297 billion (Meld. St. 2. (2005-2006), p**.** 31)

2006: NOK 376,6 billion (Meld. St. 2. (2007-2008), p. 35)

2007: NOK 337,4 billion (Meld. St. 2. (2007-2008), p. 35)

2008: NOK 437,7 billion (Meld. St. 2. (2008-2009), p. 37)

2009: NOK 304,5 billion (Meld. St. 2. (2009-2010), p. 36)

2010: NOK 296,1 billion (Meld. St. 2. (2010-2011), p. 38)

2011: NOK 372,2 billion (Meld. St. 1. (2012-2013), p. 49)

2012: NOK 421,1 billion (Meld. St. 1. (2014-2015), p. 53)

2013: NOK 378,7 billion (Meld. St. 1. (2014-2015), p. 53

2014: NOK 347 billion (Meld. St. 1. (2015-2016), p. 46)

2015: NOK 247,2 billion (Meld. St. 1. (2016-2017), p. 43)

2016: NOK 152,6 billion (Meld. St. 1. (2017-2018), p. 47)

2017: NOK 194,4 billion (Meld. St. 1. (2018-2019), p 51)

2018: NOK 273, 5 billion (Med. St. 1. (2019-2020), p. 50)

2019: NOK 283,2 billion (Meld. St. 1. (2020-2021), p. 56)

2020: NOK 114,7 billion (Meld. St. 1. (2020-2021), p. 56)

2021: NOK 122,3 billion (Meld. St. 1. (2020-2021), p. 56)

The state budget expenses

	Billions	Billions	The deficit as a percentage
Year	The state budget's total expenses	The oil-adjusted budget deficit as of 31.12.XX	of the total expenses
2001	516,8	1,64	0,32%
2002	584,2	62,40	10,68%
2003	592,7	66,15	11,16%
2004	622,2	79,20	12,73%
2005	650,1	64,80	9,97%
2006	683,5	44,00	6,44%
2007	715,1	1,34	0,19%
2008	778,6	11,80	1,52%
2009	868,7	95,56	11,00%
2010	892,9	104,00	11,65%
2011	952,1	79,40	8,34%
2012	996,1	100,90	10,13%
2013	1 063,1	116,40	10,95%
2014	1 127,1	160,00	14,20%
2015	1 194,5	185,30	15,51%
2016	1 246,1	208,40	16,72%
2017	1 280,9	222,80	17,39%
2018	1 318,1	218,50	16,58%
2019	1 378,1	227,60	16,52%
2020	1 552,5	370,50	23,86%
2021	1 595,0	412,80	25,88%

Table 4: The state budgets total expenses (sources below), the oil-adjusted budget deficit (Meld. St. 1. (2021-2022), p. 199) and the deficit as a percentage of the total expenses

The source for the state budgets total expenses:

2001: NOK 516,8 billion (Meld. St. 1. (2003-2004), p. 58)

2002: NOK 584,2 billion (Meld. St. 1. (2004-2005), p. 55)

2003: NOK 592,7 billion (Meld. St. 1. (2004-2005), p. 55)

2004: NOK 622,2 billion (Meld. St. 1. (2006-2007), p.62)

2005: NOK 650,1 billion (Meld. St. 1. (2007-2008), p. 60)

2006: NOK 683,5 billion (Meld. St. 1. (2008-2009), p.63)

2007: NOK 715,1 billion (Meld. St. 1. (2009-2010), p. 56)

2008: NOK 778,6 billion (Meld. St. 1. (2010-2011), p. 53)

2009: NOK 868,7 billion (Meld. St. 1. (2011-2012), p. 47)

2010: NOK 892,9 billion (Meld. St. 1. (2012-2013), p.49)

2011: NOK 952,1 billion (Meld. St. 1. (2013-2014), p. 54)

2012: NOK 996,1 billion (Meld. St. 1. (2014-2015), p. 53)

2013: NOK 1 063,1 billion (Meld. St. 1. (2014-2015), p. 53)

2014: NOK 1 127,1 billion (Meld. St. 1. (2015-2016), p. 46)

2015: NOK 1 194,5 billion (Meld. St. 1. (2016-2017), p. 43)

2016: NOK 1 246,1 billion (Meld. St. 1. (2017-2018), p. 47)

2017: NOK 1 280,9 billion (Meld. St. 1. (2018-2019), p. 51)

2018: NOK 1 318,1 billion Meld. St. 1. (2019-2020), p. 50)

2019: NOK 1 378,1 billion (Meld. St. 1. (2020-2021), p. 56)

2020: NOK 1 552,5 billion (Meld. St. 1. (2021-2022), p. 59)

2021: NOK 1 595 billion (Meld. St. 1. (2021-2022), p. 59)

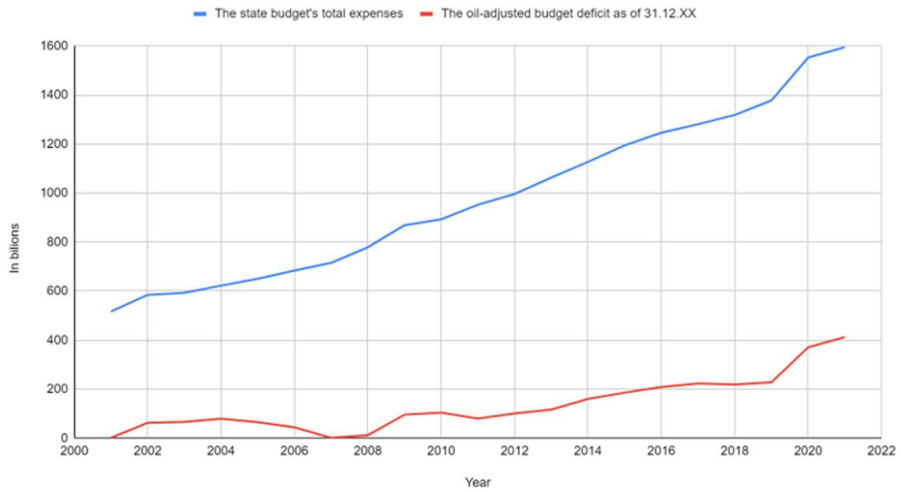

Figure 15: Total expenses of the state budget (blue line) (see source above) and the oil-adjusted deficit (red line) for 2001 until 2021 (Meld. St. 1. (2021-2022), p. 199)

Figure 15 shows how the state budget's total expenses have increased more than the oil-adjusted budget deficit the last 21 years.

A 50 percent stock market crash

	Billions	Billions	Percent	Billions	Billions		
	Value GPFG	Value GPFG	Equity share of the GPFG	Equities value in billions	Stock market crash	New value of GPFG	New value of GPFG
Year	as of 01.01.XX	as of 31.12.XX	as of 31.12.XX	as of 31.12.XX	of 50 % as of 31.12.XX	after crash as of 01.01.XX	after crash as of 31.12.XX
2001	386,6	619,3	40,2%	248,72	124,4		494,9
2002	619,3	604,6	37,7%	228,14	114,1	494,9	490,5
2003	604,6	847,1	42,54%	360,36	180,2	490,5	666,9
2004	847,1	1 011,5	41,0%	414,21	207,1	666,9	804,4
2005	1 011,5	1 390,1	41,6%	578,28	289,1	804,4	1 101,0
2006	1 390,1	1 782,8	40,7%	725,42	362,7	1 101,0	1 420,1
2007	1 782,8	2 018,5	47,5%	958,79	479,4	1 420,1	1 539,1
2008	2 018,5	2 279,6	49,6%	1 130,68	565,3	1 539,1	1 714,3
2009	2 279,6	2 642,0	62,4%	1 648,61	824,3	1 714,3	1 817,7
2010	2 642,0	3 080,9	61,5%	1 894,75	947,4	1 817,7	2 133,5
2011	3 080,9	3 307,9	58,7%	1 941,74	970,9	2 133,5	2 337,0
2012	3 307,9	3 824,5	61,2%	2 340,59	1 170,3	2 337,0	2 654,2
2013	3 824,5	5 032,4	61,7%	3 104,99	1 552,5	2 654,2	3 479,9
2014	5 032,4	6 430,6	61,3%	3 941,96	1 971,0	3 479,9	4 459,6
2015	6 430,6	7 460,8	61,2%	4 566,01	2 283,0	4 459,6	5 177,8
2016	7 460,8	7 509,9	62,5%	4 693,69	2 346,8	5 177,8	5 163,1
2017	7 509,9	8 484,1	66,6%	5 650,41	2 825,2	5 163,1	5 658,9
2018	8 484,1	8 243,4	66,3%	5 465,37	2 732,7	5 658,9	5 510,7
2019	8 243,4	10 086,2	70,8%	7 141,03	3 570,5	5 510,7	6 515,7
2020	10 086,2	10 907,1	72,8%	7 940,37	3 970,2	6 515,7	6 936,9
2021	10 907,1	12 340,00	72,0%	8 884,80	4 442,4	6 936,9	7 897,6

Table 5: Different data necessary to make the 50 percent stock market crash

	Billions	Billions	Billions
	The allowed withdrawal from the monetary action	The allowed withdrawal from the monetary action	The difference in the monetary action rule before
Year	rule after the crash of 50 % of shares as of 01.01.XX	rule after the crash of 50 % of shares as of 31.12.XX	and after the 50 % stock market crash
2001		19,8	
2002	19,8	19,6	5,0
2003	19,6	26,7	4,6
2004	26,7	32,2	7,2
2005	32,2	44,0	8,3
2006	44,0	56,8	11,6
2007	56,8	61,6	14,5
2008	61,6	68,6	19,2
2009	68,6	72,7	22,6
2010	72,7	85,3	33,0
2011	85,3	93,5	37,9
2012	93,5	106,2	38,8
2013	106,2	139,2	46,8
2014	139,2	178,4	62,1
2015	178,4	207,1	78,8
2016	207,1	206,5	91,3
2017	154,9	169,8	70,4
2018	169,8	165,3	84,8
2019	165,3	195,5	82,0
2020	195,5	208,1	107,1
2021	208,1	236,9	119,1
SUM		2393,8	945,0

Table 6: The allowed withdrawal as of the monetary action rule after the stock market crash of 50 percent, as of 01.01.XX and as of 31.12.XX, and the difference in the monetary action rule before and after the 50 percent stock market crash[22]

[22] 2002: NOK 5 billion = 24,8 (The value of the GPFG as of 01.01.02 (NOK 619,3 billion) * 0,04) - 19,8 (The allowed withdrawal from the monetary action rule after the stock market crash as of 01.01.02).

The difference in the monetary action rule was calculated like this:

Without a market crash: What the monetary action ruled allowed Norway to withdraw before a market crash, which is the value of the GPFG as of 01.01.XX multiplied by 4 percent from 2001 until 2016. From 2017 until 2021, the value was multiplied by 3 percent.

With a market crash: To find the new value of the shares after the stock market crash, we first multiplied the equity share of the GPFG in percent by the value of the fund as of 31.12.XX. When we had the share of the equities in billions, we multiplied it by 0,5 to get the market crash. After that, we found the new value of the GPFG as of 01.01.XX and 31.12.XX. Then we multiplied the value of the fund as of 01.01.XX with 4 percent from 2001 to 2016, and with 3 percent from 2017 to 2021.

To find the difference, we subtracted the value without the market crash by the value after the market crash.

It gives figure 16:

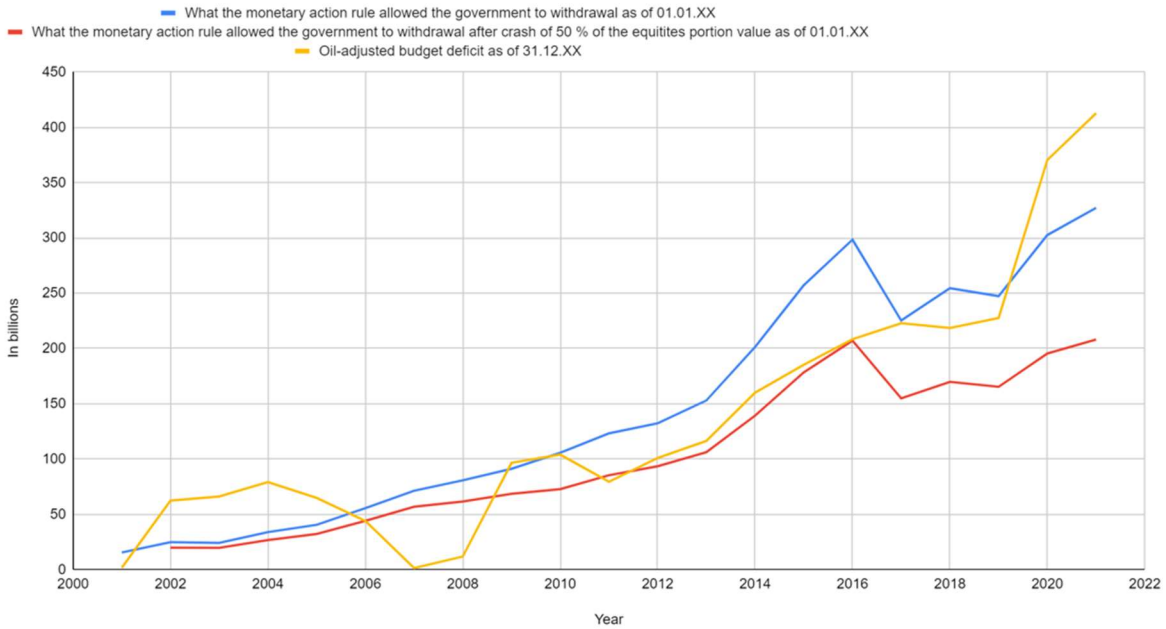

Figure 16: The monetary action rule before (blue line) and after a stock market crash of 50 percent (red line) with the oil-adjusted budget deficit (yellow line)

The blue line in figure 16 shows what the monetary action rule allowed the government to withdraw from the GPFG as of 01.01.XX, without a market crash. The red line shows what

the monetary action rule allowed the government to withdraw with a market crash, as of 01.01.XX.

Initially, there was very little difference between the red and blue lines until 2008, although the figure shows a significant increase with an upward trend which increases over time. The difference grew until it reached a significant difference in 2016. This was when the revised 3 percent monetary action rule was implemented. The difference fell from NOK 91,3 billion in 2016 to NOK 70,4 billion in 2017. But, it begins to widen again in subsequent years, but not to the same magnitude as before. Although, in the last two years, the difference has grown further, with NOK 107,1 billion in 2020 and NOK 119,1 billion in 2021, due to the extraordinary Covid-19 situation.

The yellow line shows the actual oil-adjusted budget deficit as of 31.12.XX. The total withdrawal from the GPFG since 2001 has been NOK 2 834,49 billion, which corresponds to the oil-adjusted budget deficits. See table 2 in the Appendix for this. The estimated allowed withdrawals with a 50 percent stock market crash is NOK 2 393,8 billion; see table 6 above. The difference is NOK 440,7 billion. It is worth noting that this is the difference with a 50 percent fall in the stocks every year from 2001 to 2021, keeping all else constant.

A 3 percent withdrawal of the fund, with and without the stock market crash, as a percentage of the state budgets total expenses

Year	3 % withdrawal without market crash as of the state budgets total expenses	3 % withdrawal with market crash as of the state budgets total expenses
2001	2,24%	
2002	3,18%	2,54%
2003	3,06%	2,48%
2004	4,08%	3,22%
2005	4,67%	3,71%
2006	6,10%	4,83%
2007	7,48%	5,96%
2008	7,78%	5,93%
2009	7,87%	5,92%
2010	8,88%	6,11%
2011	9,71%	6,72%
2012	9,96%	7,04%
2013	10,79%	7,49%
2014	13,39%	9,26%
2015	16,15%	11,20%
2016	17,96%	12,47%
2017	17,59%	12,09%
2018	19,31%	12,88%
2019	17,95%	12,00%
2020	19,49%	12,59%
2021	20,51%	13,05%

Table 7: The 3 percent withdrawal with and without the market crash as of the state budget's total expenses

How to make table 7:

The 3 percent withdrawal without the market crash was made by multiplying 3 percent with the value of the GPFG as of 01.01.XX, and dividing it by the state budget's total expenses that year. The same method was done after the 50 percent market crash and how the market crash was made, is explained above in table 6.

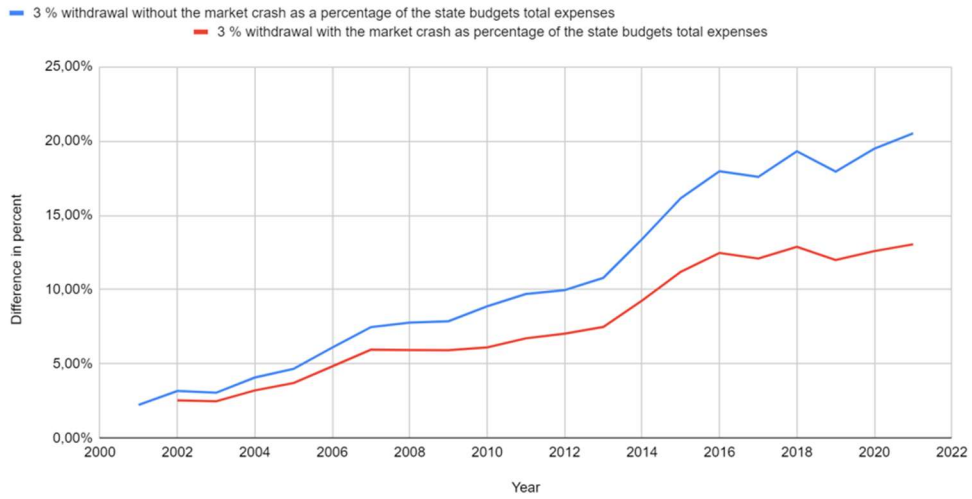

Figure 17: Withdrawals as a percentage of the state budget's total expenses, with (red line) and without a 50 percent stock market crash (blue line)

Figure 17 shows the two monetary action rules, with and without a 50 percent stock market crash, as a percentage of the state budget total expenses. The blue line, which is the monetary action rule without the crash, has larger percentages than the rule with the crash.

As you can see from the figure above, there initially was a slight difference between withdrawals with and without the 50 percent stock market crash as a percentage of the state budget's total expenses. The difference has grown larger since 2012, when the increases in the value of the fund grew at a much larger rate than in the period from 2001 to 2012. This meant that there could and were larger increases in the withdrawals to cover the state budget.

To summarize, the difference in withdrawals with and without a stock market crash has increased. This lends credibility to our theory that the Norwegian economy has become too dependent on the GPFG. See table 7 on how figure 17 was made.

Table to figure 9 in the thesis:

	Billions	Billions	Billions
	3 % withdrawal	3 % withdrawal	
Year	without market crash	with market crash	The difference
2001	11,6		
2002	18,6	14,85	3,7
2003	18,1	14,72	3,4
2004	25,4	20,01	5,4
2005	30,3	24,13	6,2
2006	41,7	33,03	8,7
2007	53,5	42,60	10,9
2008	60,6	46,17	14,4
2009	68,4	51,43	17,0
2010	79,3	54,53	24,7
2011	92,4	64,01	28,4
2012	99,2	70,11	29,1
2013	114,7	79,63	35,1
2014	151,0	104,40	46,6
2015	192,9	133,79	59,1
2016	223,8	155,33	68,5
2017	225,3	154,89	70,4
2018	254,5	169,77	84,8
2019	247,3	165,32	82,0
2020	302,6	195,47	107,1
2021	327,2	208,11	119,1

Table 8: The difference between allowed withdrawals with and without a 50 percent stock market crash, with a monetary action rule of 3 percent

The currency exchange rate

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
The market value of the GPFG per 31.12.XX in billions	619,3	604,6	847,1	1 011,5	1 390,1	1 782,8	2 018,5	2 279,6	2 642,0	3 080,9	3 307,9	3 824,5	5 032,4
An appreciation of the Norwegian currency of 30% in billions	805,1	786,0	1 101,2	1 315,0	1 807,1	2 317,6	2 624,1	2 963,5	3 434,6	4 005,2	4 300,3	4 971,9	6 542,1
An depreciation of the Norwegian currency of 30% in billions	433,5	423,2	593,0	708,1	973,1	1 248,0	1 413,0	1 595,7	1 849,4	2 156,6	2 315,5	2 677,2	3 522,7
The monetary action rule by the percentage rule that year in billions	24,8	24,2	33,9	40,5	55,6	71,3	80,7	91,2	105,7	123,2	132,3	153,0	201,3
The monetary action rule with an appreciated currency in billions	32,2	31,4	44,0	52,6	72,3	92,7	105,0	118,5	137,4	160,2	172,0	198,9	261,7
The monetary action rule with an depreciated currency in billions	17,3	16,9	23,7	28,3	38,9	49,9	56,5	63,8	74,0	86,3	92,6	107,1	140,9
Difference between 30% appreciation and 30% depreciation of the curency, in billions	14,9	14,5	20,3	24,3	33,4	42,8	48,4	54,7	63,4	73,9	79,4	91,8	120,8

Table 9: Different numbers for the currency exchange rate analysis, from 2001 to 2013

Year	2014	2015	2016	2017	2018	2019	2020
The market value of the GPFG per 31.12.XX in billions	6 430,6	7 460,8	7 509,9	8 484,1	8 243,4	10 086,2	10 907,1
An appreciation of the Norwegian currency of 30% in billions	8 359,8	9 699,0	9 762,9	11 029,3	10 716,4	13 112,1	14 179,2
An depreciation of the Norwegian currency of 30% in billions	4 501,4	5 222,6	5 256,9	5 938,9	5 770,4	7 060,3	7 635,0
The monetary action rule by the percentage rule that year in billions	257,2	298,4	300,4	254,5	247,3	302,6	327,2
The monetary action rule with an appreciated currency in billions	334,4	388,0	390,5	330,9	321,5	393,4	425,4
The monetary action rule with an depreciated currency in billions	180,1	208,9	210,3	178,2	173,1	211,8	229,0
Difference between 30% appreciation and 30% depreciation of the curency, in billions	154,3	179,1	180,2	152,7	148,4	181,6	196,3

Table 10: Different numbers for the currency exchange rate analysis, from 2014 to 2020

	Billions	Billions
	Value GPFG	3 % withdrawal
Year	as of 01.01.XX	without market crash
2001	386,6	11,6
2002	619,3	18,6
2003	604,6	18,1
2004	847,1	25,4
2005	1 011,5	30,3
2006	1 390,1	41,7
2007	1 782,8	53,5
2008	2 018,5	60,6
2009	2 279,6	68,4
2010	2 642,0	79,3
2011	3 080,9	92,4
2012	3 307,9	99,2
2013	3 824,5	114,7
2014	5 032,4	151,0
2015	6 430,6	192,9
2016	7 460,8	223,8
2017	7 509,9	225,3
2018	8 484,1	254,5
2019	8 243,4	247,3
2020	10 086,2	302,6
2021	10 907,1	327,2

Table 11: The value of the GPFG as of 01.01.XX and a 3 percent withdrawal from the fund, each year. The formula is: the value of the GPFG as of 01.01.XX * 0,03

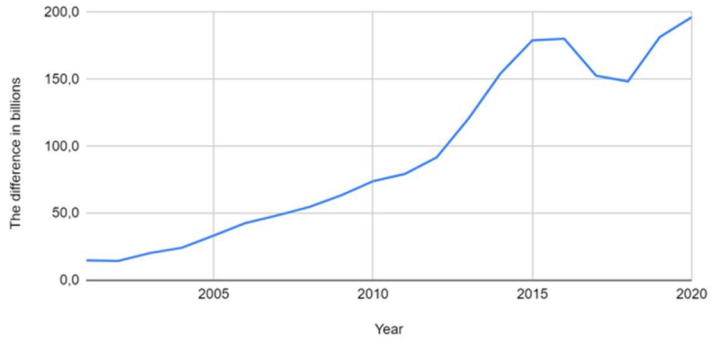

Figure 18: The difference between a 30 percent appreciation and a 30 percent depreciation of the currency, in billions

The values are found by first multiplying the value of the GPFG as of 31.12.XX with 1,3 and 0,7. Then, the values multiplied by 4 percent from 2001 to 2016, and 3 percent from 2017 to 2021. The difference above is then found by the difference between the allowed withdrawals from the monetary action rule with the currency's appreciated and depreciated value.

Solution 1: The Cash Flow Method

To see the numbers used to make figure 12, see table 12 below.

	Million	Billion	Million	Percent	Billion	Billion	Million	Million	Million
		The oil-adjusted budget	The oil-adjusted	Monetary action	Value of the GPFG			Difference between the	Difference between the
Year	The cash flow	deficit	budget deficit	rule in percent	as of 01.01.XX	Using the monetary action rule	The monetary action rule	monetary action rule and the cash flow	cash flow and the oil-adjusted deficit
2001	15 833	1,64	1 640	4,00%	386,6	15,464	15 464	−369	−14 193
2002	27 066	62,40	62 400	4,00%	619,3	24,772	24 772	−2 294	35 334
2003	30 279	66,15	66 150	4,00%	604,6	24,184	24 184	−6 095	35 871
2004	34 957	79,20	79 200	4,00%	847,1	33,884	33 884	−1 073	44 243
2005	42 369	64,80	64 800	4,00%	1 011,5	40,460	40 460	−1 909	22 431
2006	59 274	44,00	44 000	4,00%	1 390,1	55,604	55 604	−3 670	−15 274
2007	70 816	1,34	1 340	4,00%	1 782,8	71,312	71 312	496	−69 476
2008	93 242	11,80	11 800	4,00%	2 018,5	80,740	80 740	−12 502	−81 442
2009	95 432	96,56	96 560	4,00%	2 279,6	91,184	91 184	−4 248	1 128
2010	88 685	104,00	104 000	4,00%	2 642,0	105,680	105 680	16 995	15 315
2011	99 664	79,40	79 400	4,00%	3 080,9	123,236	123 236	23 572	−20 264
2012	116 394	100,90	100 900	4,00%	3 307,9	132,316	132 316	15 922	−15 494
2013	125 776	116,40	116 400	4,00%	3 824,5	152,980	152 980	27 204	−9 376
2014	150 448	160,00	160 000	4,00%	5 032,4	201,296	201 296	50 848	9 552
2015	191 043	185,30	185 300	4,00%	6 430,6	257,224	257 224	66 181	−5 743
2016	201 103	208,40	208 400	4,00%	7 460,8	298,432	298 432	97 329	7 297
2017	209 163	222,80	222 800	3,00%	7 509,9	225,297	225 297	16 134	13 637
2018	225 594	218,50	218 500	3,00%	8 484,1	254,523	254 523	28 929	−7 094
2019	248 918	227,60	227 600	3,00%	8 243,4	247,302	247 302	−1 616	−21 318
2020	224 471	370,50	370 500	3,00%	10 086,2	302,586	302 586	78 115	146 029

Table 12: Different numbers for the cash flow method

Table 12 has the cash flow, the oil-adjusted budget deficit and the monetary action rule for each year. The oil-adjusted budget deficits are taken from the nation budget of 2022 (Meld. St. 1. (2021-2022), p. 199). The value of the GPFG as of 01.01.XX are also taken from the national budget of 2022 (Meld. St. 1. (2021-2022), p. 61).

The cash flows are estimated like this:

	Million
Year	The cash flow
2001	=14911+2738-1816
2002	=18705+4428-2039+7240-1268
2003	=19560+6996+2039+135+257+1292
2004	=26046+8246+251+21+393
2005	=27815+10309+1250+1239+1756
2006	=43014+14232-3329+2174+3183
2007	=18823+51993
2008	=30590+62652
2009	=38632+56800
2010	=41257+45752+1676
2011	=49208+48036+2230+130+60
2012	=64403+49062+2424+177+84+244
2013	=72637+49511+2620+1008
2014	=82623+63309+2550+1966
2015	=108904+75283+3324+3532
2016	=118517+74832+3657+4097
2017	=128293+73575+3869+3426
2018	=146082+70360+5822+3330
2019	=172591+67751+5865+2711
2020	=152788+60255+8375+3053

Table 13: How we estimated the cash flows for each year

Sources for the cash flows:

2001: NOK 15 833 million (Norges Bank, 2002, p. 29)

2002: NOK 27 066 million (Norges Bank, 2003, p. 29)

2003: NOK 30 279 million (Norges Bank, 2004, p. 31)

2004: NOK 34 957 million (Norges Bank Investment Management, 2006, p. 35)

2005: NOK 42 369 million (Norges Bank Investment Management, 2007, p. 56)

2006: NOK 59 274 million (Norges Bank Investment Management, 2007, p. 56)

2007: NOK 70 816 million (Norges Bank Investment Management, 2008, p. 64)

2008: NOK 93 242 million (Norges Bank Investment Management, 2009, p. 74)

2009: NOK 95 432 million (Norges Bank Investment Management, 2010, p. 76)

2010: NOK 88 685 million (Norges Bank Investment Management, 2012, p. 73)

2011: NOK 99 664 million (Norges Bank Investment Management, 2013, p. 57)

2012: NOK 116 394 million (Norges Bank Investment Management, 2013, p. 57)

2013: NOK 125 776 million (Norges Bank Investment Management, 2015, p. 63)

2014: NOK 150 448 million (Norges Bank Investment Management, 2015, p. 63**)**

2015: NOK 191 043 million (Norges Bank Investment Management, 2017, p. 78)

2016: NOK 201 103 million (Norges Bank Investment Management, 2017, p. 78)

2017: NOK 209 163 million (Norges Bank Investment Management, 2019a, p. 96)

2018: NOK 225 594 million (Norges Bank Investment Management, 2019a, p. 96)

2019: NOK 248 918 million (Norges Bank Investment Management, 2021, p. 102)

2020: NOK 224 471 million (Norges Bank Investment Management, 2021, p. 102)

Solution 2: The GDP as a fixed percentage of the GPFG

	Billions	Billions	The structural oil	
	GDP - Mainland Norway	Structured oil-adjusted budget	adjusted budget deficit	5 % withdrawals based
Year	as of 31.12.XX	deficit as of 31.12.XX	as % of GDP	on the GPD
2001	1200	16,80	1,4%	60,0
2002	1258	32,70	2,6%	62,9
2003	1352	39,20	2,9%	67,6
2004	1443	43,30	3,0%	72,2
2005	1520	45,60	3,0%	76,0
2006	1623	42,20	2,6%	81,2
2007	1704	44,30	2,6%	85,2
2008	1869	54,20	2,9%	93,4
2009	1963	94,20	4,8%	98,1
2010	2044	102,20	5,0%	102,2
2011	2159	95,00	4,4%	108,0
2012	2302	110,50	4,8%	115,1
2013	2412	125,40	5,2%	120,6
2014	2512	150,70	6,0%	125,6
2015	2625	175,90	6,7%	131,3
2016	2716	206,40	7,6%	135,8
2017	2810	222,00	7,9%	140,5
2018	2945	215,00	7,3%	147,3
2019	3062	235,80	7,7%	153,1
2020	3173	364,90	11,5%	158,7
2021	3283	397,20	12,1%	164,1
SUM				2298,7

Table 14: The SOABD (Meld. St. 1. (2021-2022), p. 61), the GDP of Norway, the SOABD as a percentage of the GDP and our estimated 5 percent withdrawals based on the GDP

How the GDP of Norway was calculated: The SOABD divided by the SOABD in percent.

How the 5 percent withdrawals based on the GDP was calculated: 0,05 * the GDP each year.

Solution 3: Lower the percentage of the monetary action rule to 2 percent

		Billions	Billions		Billions	Billions	Billions
	The monetary action	The value of the GPFG	The value of the GPFG	The actual withdrawal from the	The withdrawal with a monetary	The actual withdrawal from	The difference - What could
Year	in percent that year	as of 01.01.XX	as of 31.12.XX	fund in percent that year	action rule of 2 %	the fund that year	have been saved that year
2001	4 %	386,6	619,3			1,64	
2002	4 %	619,3	604,6	5,3%	12,386	62,40	50,01
2003	4 %	604,6	847,1	6,5%	12,092	66,15	54,06
2004	4 %	847,1	1 011,5	5,1%	16,942	79,20	62,26
2005	4 %	1 011,5	1 390,1	4,5%	20,23	64,80	44,57
2006	4 %	1 390,1	1 782,8	3,0%	27,802	44,00	16,20
2007	4 %	1 782,8	2 018,5	2,5%	35,656	1,34	−34,32
2008	4 %	2 018,5	2 279,6	2,7%	40,37	11,80	−28,57
2009	4 %	2 279,6	2 642,0	4,1%	45,592	96,56	50,97
2010	4 %	2 642,0	3 080,9	3,9%	52,84	104,00	51,16
2011	4 %	3 080,9	3 307,9	3,1%	61,618	79,40	17,78
2012	4 %	3 307,9	3 824,5	3,3%	66,158	100,90	34,74
2013	4 %	3 824,5	5 032,4	3,3%	76,49	116,40	39,91
2014	4 %	5 032,4	6 430,6	3,0%	100,648	160,00	59,35
2015	4 %	6 430,6	7 460,8	2,7%	128,612	185,30	56,69
2016	4 %	7 460,8	7 509,9	2,8%	149,216	208,40	59,18
2017	3 %	7 509,9	8 484,1	3,0%	150,198	222,80	72,60
2018	3 %	8 484,1	8 243,4	2,5%	169,682	218,50	48,82
2019	3 %	8 243,4	10 086,2	2,9%	164,868	227,60	62,73
2020	3 %	10 086,2	10 907,1	3,6%	201,724	370,50	168,78
2021	3%	10 907,1	12 340,00	3,6%	218,142	412,80	194,66
SUM							1081,584

Table 15: How much larger the GPFG could have been in 2022 if the monetary action rule had been 2 percent from 2001 until 2021

	The monetary action	The expected value of the	The expected withdrawal	The expected withdrawal	An experiment with 2 % with-	The expected withdrawal with	The difference between 2.8 %
Year	rule in percent	GPFG as of 01.01.XX	from the fund in percent	with 2,8 %	-drawal from the fund	the rule of 2 %	and 2 % withdrawal from the fund
2022	3 %	10 542,20	2,80%	295,18	2,00%	210,84	84,34
2023	3 %	10 954,90	2,80%	306,74	2,00%	219,10	87,64
2024	3 %	11 486,20	2,80%	321,61	2,00%	229,72	91,89
2025	3 %	12 091,60	2,80%	338,56	2,00%	241,83	96,73
SUM				1 262,10		901,50	360,60

Table 16: The difference between a 2 percent and a 2,8 percent withdrawal from the fund from 2022 to 2025

A negative shock

Year	The expected value of the GPFG as of 01.01.XX	Expected usage in %	The expected withdrawal with 2.8 %	The expected withdrawal with 2 %	The difference between 2.8 % and 2 % withdrawal from the fund
2022	10 542,20	2,8%	295,18	210,84	84,34
2023	7 000,00	2,8%	196,00	140,00	56,00
2024	7 500,00	2,8%	210,00	150,00	60,00
2025	8 000,00	2,8%	224,00	160,00	64,00
SUM			925,18	660,84	264,34

Table 17: A negative shock affecting the value of the GPFG as of 01.01.XX and its withdrawals. All numbers except the percentages are in billions

A positive shock

Year	The expected value of the GPFG as of 01.01.XX	Expected usage in %	The expected withdrawal with 2.8 %	The expected withdrawal with 2 %	The difference between 2.8 % and 2 % withdrawal from the fund
2022	10 542,20	2,8%	295,18	210,84	84,34
2023	16 000,00	2,8%	448,00	320,00	128,00
2024	17 000,00	2,8%	476,00	340,00	136,00
2025	18 000,00	2,8%	504,00	360,00	144,00
SUM			1 723,18	1 230,84	492,34

Table 18: A positive shock affecting the value of the GPFG as of 01.01.XX and its withdrawals. All numbers except the percentages are in billions

Solution 4: Cover budget deficits by loans and do not withdraw from the GPFG

Year	Year	2001	2002	2019	2020	Value 2021	T
	Withdrawals						
2001	1,64	−5,34%	−19,10%	22,01%	11,41%	5,81	
2002	62,40		−19,10%	22,01%	11,41%	233,38	
2003	66,15			22,01%	11,41%	305,81	
2004	79,20			22,01%	11,41%	305,22	
2005	64,80			22,01%	11,41%	240,28	
2006	44,00			22,01%	11,41%	142,77	
2007	1,34			22,01%	11,41%	4,11	
2008	11,80			22,01%	11,41%	37,63	
2009	96,56			22,01%	11,41%	329,86	
2010	104,00			22,01%	11,41%	329,32	
2011	79,40			22,01%	11,41%	229,63	
2012	100,90			22,01%	11,41%	295,93	
2013	116,40			22,01%	11,41%	319,95	
2014	160,00			22,01%	11,41%	351,53	
2015	185,30			22,01%	11,41%	327,71	
2016	208,40			22,01%	11,41%	318,99	
2017	222,80			22,01%	11,41%	334,51	
2018	218,50			22,01%	11,41%	287,89	
2019	227,60			22,01%	11,41%	309,38	
2020	370,50			22,01%	11,41%	503,63	
SUM	2 421,69				SUM	5 213,32	

Table 19: Withdrawals reinserted to show that the GPFG could have been NOK 5 213,32 billion more in 2021. All numbers in billions

Year	Value 2021	The accumulative value
Year		
2001	5,81	5,81
2002	233,38	239,18
2003	305,81	545,00
2004	305,22	850,22
2005	240,28	1 090,50
2006	142,77	1 233,27
2007	4,11	1 237,37
2008	37,63	1 275,00
2009	329,86	1 604,86
2010	329,32	1 934,18
2011	229,63	2 163,81
2012	295,93	2 459,74
2013	319,95	2 779,69
2014	351,53	3 131,22
2015	327,71	3 458,93
2016	318,99	3 777,92
2017	334,51	4 112,43
2018	287,89	4 400,32
2019	309,38	4 709,70
2020	503,63	5 213,32
SUM	5 213,32	

Table 20: The value in 2021 and the accumulated value. All numbers in NOK billions

5 years								
			Year	2001	2002	2019	2020	Sum paid in interest costs
Year	Withdrawals from GPFG in billions		Yearly interest rate on government bonds, 5 years	6,31%	6,36%	1,28%	0,56%	
2001	1,64		Estimated Interest paid, in billions	0,10	0,10	0,01	0,01	1,12
2002	62,40				3,97	0,67	0,67	42,36
2003	66,15					0,95	0,95	39,04
2004	79,20					**1,01**	1,01	36,72
2005	64,80					**0,64**	**0,36**	23,33
2006	44,00					0,37	0,37	16,06
2007	1,34					0,01	0,01	0,48
2008	11,80					0,17	0,17	4,26
2009	96,56					**1,24**	1,24	27,34
2010	104,00					**1,03**	**0,58**	20,45
2011	79,40					0,67	0,67	13,50
2012	100,90					1,08	1,08	12,34
2013	116,40					1,45	1,45	15,59
2014	160,00					**2,05**	2,05	18,66
2015	185,30					**1,83**	**1,04**	10,21
2016	208,40					1,75	1,75	8,75
2017	222,80					2,38	2,38	9,54
2018	218,50					3,15	3,15	9,44
2019	227,60					2,91	2,91	5,83
2020	370,50						2,07	2,07
Sum withdrawals	2 421,69						Sum in billions	317,08

Table 21: The total interest costs with a 5-year interest rate

3 years								
			Year	2001	2002	2019	2020	Sum paid in interest costs
Year	Withdrawals from GPFG in billions		Yearly interest rate on government bonds, 3 years	6,44%	6,39%	1,23%	0,44%	
2001	1,64		Estimated Interest paid, in billions	0,11	0,11	0,02	0,02	0,97
2002	62,40				3,99	0,48	**0,27**	34,63
2003	66,15					0,76	0,76	27,86
2004	79,20					**0,97**	0,97	31,51
2005	64,80					0,50	**0,29**	23,54
2006	44,00					0,51	0,51	12,94
2007	1,34					**0,02**	0,02	0,41
2008	11,80					0,09	**0,05**	3,26
2009	96,56					1,11	1,11	17,55
2010	104,00					**1,28**	1,28	17,22
2011	79,40					0,61	**0,35**	11,14
2012	100,90					1,16	1,16	10,14
2013	116,40					1,43	1,43	10,69
2014	160,00					1,23	0,70	11,70
2015	185,30					2,13	2,13	10,62
2016	208,40					**2,56**	2,56	8,94
2017	222,80					1,72	**0,98**	6,13
2018	218,50					2,51	2,51	7,54
2019	227,60					2,80	2,80	5,60
2020	370,50						1,63	1,63
Sum withdrawals	2421,69						Sum in billions	254,00

Table 22: The total interest costs with a 3-year interest rate

Value of the fund with different interest rates:

With a 10-year interest rate:

The value of the GPFG as of 07.03.22: NOK 11 400 billion

Reinserted withdrawals to the GPFG: NOK 5 213,32 billion

Interest costs of a debt with a 10-year interest rate: NOK 452,3 billion

The value of the GPFG as of 07.03.22: NOK 11 400 + 5213,32 - 452,3 billion = NOK 16 161,02 billion

With a 5-year interest rate:

The value of the GPFG as of 07.03.22: NOK 11 400 billion

Reinserted withdrawals to the GPFG: NOK 5 213,32 billion

Interest costs of debt with a 5-year interest rate: NOK 317,08 billion

The value of the GPFG as of 07.03.22: NOK 11 400 + 5213,32 - 317,08 billion = NOK 16 296,24 billion

With a 3-year interest rate:

The value of the GPFG as of 07.03.22: NOK 11 400 billion

Reinserted withdrawals to the GPFG: NOK 5 213,32 billion

Interest costs of debt with a 3-year interest rate: NOK 254 billion

The value of the GPFG as of 07.03.22: NOK 11 400 + 5213,32 - 254 billion = NOK 16 359,32 billion