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Fiscal spending in an oil rich economy

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Abstract

In this thesis we investigate two matters concerning Norwegian fiscal policy. We first assess the effects of an oil revenue shock on mainland GDP and fiscal spending. Then we examine how discretionary fiscal spending affects mainland GDP. This is done through an empirical SVAR analysis. Acknowledging that the effects of fiscal policy depends on country characteristics, our SVAR model is built to fit Norway, a small open and oil dependent economy with a unique fiscal framework. Our results make it clear that mainland GDP increases following a hike in government oil revenue and that fiscal spending has been more procyclical to oil revenue in our later sample, i.e., after the adoption of the fiscal spending rule. We show that discretionary fiscal spending has a positive, yet modest, short term effect on Norwegian GDP. The results are robust for different specifications of our SVAR model, as well as a proxy SVAR.

Preface

This thesis completes our master's degree at BI Norwegian Business School. The work has been carried out throughout the spring 2018. We would like to give special thanks to our supervisor Professor Hilde C. Bjørnland for guidance and helpful comments. We would also like to thank Centre for Applied Macro- and Petroleum economics (CAMP) for providing us the FNI; PhD-candidate Thomas S. Gundersen for helping out with our Matlab code; and Associate Professor Steffen Grønneberg for introducing us to R.

Contents

1 Introduction

To insulate the domestic economy from oil price fluctuations and to prevent overspending, Norway adopted a fiscal rule in 2001. The rule allows transfers from the Norwegian sovereign wealth fund to the central government budget which shall, over time, follow the expected real return on the fund. The fiscal guidelines also leave space for temporary deviations from the rule over the business cycle. Despite the spending restriction, public sector expenses as a percentage of mainland GDP has grown considerably; in 2017 it was almost 60%, the highest in OECD; and public employment as a share of total employment was more than 30% (Norwegian Ministry of Finance, 2018). This tells us that in order to understand Norwegian fiscal policy we must understand the relationship between government oil revenues, the fiscal framework and fiscal spending.

To counteract the negative effects of the oil price decline in 2014, the Norwegian government looked to fiscal expansion, i.e. allowed for a temporary deviation from the fiscal spending rule to stimulate the real economy. Using fiscal policy as a stabilization tool has for a long time been controversial, mainly due to the belief that the implementation lags are too long for fiscal policy to be useful to counteract recessions (Ramey and Zubairy, 2018). Therefore, macroeconomic stabilization policy was for a long time mainly functioned by Central Banks. With policy rates at the zero lower bound in the aftermath of the financial crisis however, monetary policy ran out of steam and could no longer mitigate the economic downturn. As a result, governments called upon fiscal policy to get the economy back on track. By 2009 almost all OECD economies as well as many developing countries had announced or implemented fiscal stimulus packages (Burriel et al., 2010).

Since the 1960s up until the financial crisis there has not been much research on fiscal stabilization policy (Ramey and Zubairy, 2018). Economists still disagree on the size of fiscal multipliers. The matter is also politically disputed because economists and policy makers at different sides of the political spectrum disagree about the role and size of the government. There is a rapidly growing literature that empirically study the short-term effects of fiscal stimulus. Yet, the results differ depending on identification strategy, sample period and which assumptions that are made. The two-way causality between fiscal policy and the state of the economy makes it challenging to determine the direction of causation. Besides, the possibility of fiscal foresight complicates the identification of true the fiscal shocks.

Ilzetzki et al. (2013) show that the effects of fiscal policy depend crucially on country characteristics such as exchange rate regime, level of development, openness to trade, and public debt. Norway has features which makes an examination of its fiscal policy interesting: The economy is small, open, has a floating exchange rate, and a unique fiscal framework. Oil revenues constitute a large share of total government revenues, estimated at 18% in 2018; and petroleum revenue spending makes up a high proportion of mainland GDP, almost 8% for 2018 (Norwegian Ministry of Finance, 2018). In other words, fiscal policy depends to a large extend on government oil revenues.

In this thesis we aim to answer two things about Norwegian fiscal policy: (1) How does a sudden increase in government oil revenue (oil revenue) affect mainland GDP and fiscal spending? (2) What is the effect of discretionary fiscal spending on GDP?[1] To answer these questions we conduct an empirical analysis, employing a structural VAR building on the work of Blanchard and Perotti (2002). Acknowledging that the effects of fiscal policy depends on country characteristics the model is extended to fit the Norwegian economy. Our SVAR is composed of four endogenous variables: Oil revenue, a fiscal variable, mainland GDP and the interest rate. OECD production is included as an exogenous variable. Different fiscal variables, namely government spending, the structural, non-oil budget deficit and public employment, are used for different specifications of the model. To our knowledge, there are not many SVAR studies about Norwegian fiscal policy. We therefore want to explore different specifications rather than stick to one particular model. Since most of the growth in the public sector in our sample period comes from increased government expenditure, rather than massive tax cuts (Norwegian Ministry of Finance, 2018) we focus on government expenditure, not taxes. We check for subsample stability as well as add taxes to the SVAR in the sensitivity analysis. We also employ the proxy SVAR and aim to control for fiscal foresight by using the Financial News Index (FNI) in a modified version of our SVAR.

Our results make it clear that mainland GDP increases following a hike in oil revenue. We also find that fiscal spending is procyclical to oil revenue, particularly so in our later sample. The first supports the findings in Bjørnland et al. (2018) where the standard Dutch disease prediction is altered. The latter is in line with the discoveries of Bjørnland and Thorsrud (2016). They show that fiscal policy has not been less procyclical since 2001, despite the adoption of the spending rule. We also find that discretionary fiscal spending has a positive, yet modest, short term effect on the Norwegian economy, in line with

[1] GDP means GDP for mainland Norway unless otherwise specified.

many empirical studies. The results are robust for different specifications of our SVAR model as well as the proxy SVAR.

The rest of the thesis is structured as follows. Section 2 explains terms and concepts. Section 3 describes the Norwegian fiscal framework and the challenges facing an oil abundant economy. Section 4 gives an overview of related literature and empirical evidence. Section 5 presents data and identification strategy. Section 6 discusses the results from our SVAR model as well as the proxy SVAR and a model specification using the FNI. Section 7 presents a robustness analysis. Section 8 concludes.

2 Fiscal Policy

Fiscal policy shifts the government budget deficit either by public spending adjustments or tax changes. The objectives are generally both long- and short term and include a high level of employment, economic growth, optimal resource allocation, distribution of wealth, and economic stability (IMF, 2017).

2.1 Fiscal policy as a stabilization tool

Discretionary fiscal policy means changing the budget to influence aggregate demand. Since the aim is stabilization it is typically adopted countercyclically. That is, when the economy is in a downturn (upswing) government spending increases (decreases) or taxes decreases (increases). In other words, fiscal policy should be expansionary during downturns and tight during booms. Discretionary fiscal policy can also be defined as a deviation from a neutral fiscal stance. In Norway deviations from the fiscal spending rule is often used as a measure of the neutrality of fiscal policy.[2] If the structural non-oil budget deficit in percent of trend GDP of mainland Norway does not change from the previous year, the budget should have a neutral effect on economic activity (Ministry of Finance 2018). Discretionary fiscal policy typically comes in addition to automatic responses to the business cycle; so-called automatic stabilizers allow the budget balance to decrease when tax revenue falls (spike) during downturns (upturns).[3]

In most countries with a floating exchange rate, monetary policy is the first line in defence in stabilizing the economy. This is also the case for Norway.[4] This does not necessarily mean that fiscal policy can never be an effective stabilization tool. Many studies show that the impacts of fiscal policy increase under certain circumstances, for instance when monetary policy does not counteract the fiscal expansion at the zero lower bound of interest rates or during recessions, especially when the recession is deep (see e.g. Auerbach and

[2]In general, a neutral fiscal stance can be defined as a policy in which primary expenditure grows in line with potential GDP plus expected inflation, and tax revenue is a function of actual GDP (Buti and van den Noord, 2003).

[3]In countries with a large public sector such as Norway, automatic stabilization is an important part of fiscal policy. If the automatic stabilizers were not allowed to work, it could amplify the business cycle (Holden 2015).

[4]One reason is timing; the interest rate can be changed quickly while it takes more time to legislate tax and spending changes. Also, most economists believe that an independent central bank is better suited to stabilize the economy than an elected government that may be tempted to make promises on higher spending or tax cuts to be re-elected. Moreover, theory suggests that government should as far as possible smooth taxes and consumption spending. Finally, consumers might respond to fiscal stimulus in an unintended way, for instance, react to a tax cut by saving rather than spending (Durlauf et al., 2008).

Gorodnichenko (2012), Nakamura and Steinsson (2014), Baum et al. (2012) Holden and Sparrman (2011)). Ramey and Zubairy (2018) on the other hand, find that fiscal multipliers do not differ much between good and bad times, but estimate some multipliers as high as 1.5 at the zero lower bound.

2.2 Fiscal foresight

There are two types of lags in fiscal policy: The decision lag between the time of the law proposal and when it is passed and the implementation lag between legislation and when the new policy takes effect. Due to these lags forward-looking households may react to news about fiscal changes and alter their behavior before the policy actually has taken effect. The phenomenon is called fiscal foresight. Empirical estimates of the total lag vary from a few months to a couple of years (see Mertens and Ravn (2012)). We discuss the econometric challenges associated with fiscal foresight in 4.1 and 6.3.

2.3 Fiscal multipliers

Fiscal multipliers are useful measures of the short term effect of discretionary fiscal policy on GDP. The simplest definition of a fiscal multiplier is the ratio of a change in GDP to an exogenous change in a fiscal instrument with respect to their respective baselines (Spilimbergo et al., 2009). Different multipliers (impact, peak, cumulative) are used depending on the time horizon considered. We follow Blanchard and Perotti (2002) and will calculate the peak multiplier, which can be defined as the peak of the GDP response to a fiscal policy shock:

$$Fiscal\ multiplier = \frac{\Delta Y_{max}}{\Delta G_0}$$

where ΔY_{max} indicates the maximum change in GDP and ΔG_0 is the initial change in government expenditure.

Alternatively we could have calculated the cumulative multiplier (the integral under the IRF). According to Ramey and Zubairy (2018) this multiplier address the most relevant policy question since they measure the cumulative GDP gain relative to the cumulative government spending during a given period; and the the Blanchard-Perotti method of reporting multipliers tends to produce higher estimates relative to the cumulative method. In this thesis we are mostly interested in studying the direction of the multiplier. For simplicity we therefore follow Blanchard and Perotti (2002), but note that this multiplier might be somewhat larger than the cumulative multiplier.[5]

[5] Ramey and Zubairy (2018) show that they may in fact be 40-60% larger.

For the fiscal expansion to have a significant effect on the real economy, the effect on GDP must contribute more than the actual increase in the government deficit. For this to happen, the multiplier must be greater than one. The box below describes the theoretical prediction of fiscal multipliers through (New) Keynesian and Neoclassical models.

Box 1: (New) Keynesian vs. Neoclassical fiscal multipliers[a]

Neoclassical models generally predict multipliers that are zero or below unity. The underlying assumptions in the neoclassical world are the permanent income hypothesis, rational expectations and households' labor supply decision. Policy aiming to stabilize economic fluctuations will typically be undermined by forward-looking tax-payers, and thereby reduce social welfare. *Keynesian models*, on the other hand, generally predict multipliers above unity. These models are demand driven, households consume out of current disposable income and there are nominal rigidities. In the simplest Keynesian models there are no capacity constraints to hinder a fiscal-driven expansion in aggregate demand and output. Extended versions - which allow for crowding out effects, open economies and floating exchange rate regimes - typically predict smaller multipliers (but still positive). *New Keynesian* dynamic stochastic general equilibrium (DSGE) models[b], the cornerstone in modern macroeconomics, apply the neoclassical framework, but allows for Keynesian features. In particular, they assume imperfect competition and sticky prices and wages. These models predict that the nominal interest rate reaction to government spending determines the size of the multiplier. Increasing the interest rate dampen the impact of expansionary fiscal policy. By contrast, multipliers may be larger when the interest rate weapon is impaired. For instance at the zero-lower bound of interest rates, the positive effect of an increase in government spending on output raises expected inflation which in turn causes a decline in the real interest rate. Fiscal policy may therefore "do the job" for the Central Bank.[c]

[a]For a detailed theoretical overview, see e.g. Hebous (2011).

[b]DSGE can be traced back to the Lucas-critique, which suggested that economic analysis should model parameters that govern individual behavior such as preferences, technology and resource constraint. See Christiano et al. (2017) for more about DSGE models

[c]See e.g. Woodford (2011), Christiano et al. (2011) and Coenen et al. (2012)

3 Fiscal spending in an oil rich economy

Oil revenues constitute a large share of total government revenues in Norway, estimated at 18% for 2018. Petroleum revenues spending as measured by the structural non-oil deficit is estimated at NOK 231.1 billion, equivalent to 7.7% of mainland GDP the same year (Ministry of Finance 2018). Fiscal policy therefore depends to a large extent on the petroleum industry, the largest export industry in Norway since the 1990s. To prevent Dutch disease, resource-rich countries are usually advised to adopt a countercyclical fiscal policy rule (Bjørnland and Thorsrud, 2016).[6] We briefly explain the predictions from the Dutch disease theory before describing the Norwegian fiscal framework. We then discuss the relationship between oil revenues and fiscal spending in Norway.

3.1 The Dutch Disease

Large temporary resource revenues have for many countries produced relatively short-lived booms followed by difficult adjustments as production and revenues diminish (The Ministry of Finance 2018). This empirical pattern has led to many theories in-which one of the most widespread is the Dutch disease, coined after negative experiences in the Netherlands following the gas discoveries in the 1960s. The Learning by Doing (LBD) models (of Van Wijnbergen (1984), Krugman (1987) and Sachs and Warner (1995)) are some of the most influential explanations of the Dutch Disease. These models explain how an oil discovery - which is basically a foreign exchange gift - increases income and thereby demand so that workers are pushed out of the traded sector and into the non-traded sector, given that both traded and non-traded goods are normal goods. The foreign exchange gift can be used to satisfy the increased demand for traded goods. The increased demand for non-traded goods, however, will only be satisfied if a larger share of the labour force produce non-traded goods. This leads to a structural transformation of the economy in-which labour is transferred from sectors strong LBD sectors to weak LBD sectors. Hence, the Dutch disease theory predicts an inverse long run relationship between exploitation of natural resources and growth in the manufacturing sector, mainly through spending effects (Bjørnland et al., 2018).

[6] A fiscal rule imposes a long-lasting constraint on fiscal policy through numerical limits on budgetary aggregates (IMF, 2017).

3.2 The Norwegian fiscal framework

Because of the Norwegian fiscal framework, consisting of a sovereign wealth fund and a fiscal rule, Norway's handling of the petroleum wealth has been described as a great success (OECD (2005), OECD (2007)). The wealth fund, formally known as the Government Pension Fund Global (GPFG) was established in 1990. In 2001 Norway adopted the so-called "spending rule". The rule states that transfers from the GPFG to the central government budget shall, over time, follow the expected real return on the fund. The petroleum cash flow is transferred in totality to the GPFG and the long-run real return covers the government's structural non-oil deficit. The expected real rate return was set to 4% in 2001 and reduced to 3% in 2017 (reg). The purpose of the fiscal framework was twofold: To preserve the real value of the fund for the benefit of generations and at the same time shield the fiscal budget and the domestic economy from oil price fluctuations (The Ministry of Finance 2018). The GPFG therefore serves as both a savings- and a stabilization fund.

The fund works as a stabilization fund in the following ways. First, the fiscal framework set out a plan for phasing-in the petroleum income and investment returns to the Norwegian economy, at a pace slow enough to prevent overspending and a Dutch disease. Second, to counteract large cyclical fluctuations, the guidelines leave space for temporary deviations from the spending rule over the business cycle or in the case of sharp changes in the value of the fund. This should give fiscal policy flexibility to even out economic fluctuations in the event of, for instance, an oil price decline. Third, to avoid that fiscal policy aggravate the effect of oil price fluctuations, the rule is defined in terms of the structural non-oil balance. This should prevent procyclial behavior and the automatic stabilizers are allowed to work fully (Bjørnland and Thorsrud, 2016).

3.3 Has the fiscal rule insulated the economy from oil price fluctuations?

According to NOU 2015:9, "the fiscal rule has been applied in a way that has largely enabled the objectives identified in 2001 to be met". It seems to be consensus about the funds' success as a savings fund. By using only the real return of the fund every year, the GPFG is currently the largest sovereign wealth fund in the world. It also seems to be a common perception that the fiscal framework has indeed insulated the government budget, and thereby the domestic economy from volatility from the oil sector. The Governor of the Central Bank of Norway, Øystein Olsen stated for instance in 2015: "Due to the fund mechanism and the fiscal rule, actual spending is decoupled from current petroleum revenues." According to Bjørnland and Thorsrud (2016), however, very little is actually known about how, or indeed if, a fiscal spending rule like that of Norway, manages to shield an oil economy from oil price fluctuations. By employing a time-varying dynamic factor model they discover that as a stabilization fund the GPFG and the fiscal framework has in fact been pro-cyclical to the price of oil despite the rule, at odds with common perceptions and theoretical predictions. Their interpretation is that withdrawing a fixed percentage each year of a growing fund will not be sufficiently countercyclical over the commodity price cycle. They argue that this has been especially evident the last decade when a massive hike in commodity prices caused a large spending potential (Bjørnland and Thorsrud, 2016). This implies that the fiscal rule has in fact not effectively insulated the domestic economy from oil price volatility. Based on these findings - and the high correlation between the price of oil and oil revenue (20.24%, see appendix A.1) we could expect government oil revenues to have a direct impact on fiscal spending, despite the adoption of the fiscal rule. The figure below shows the development in government oil revenues and government petroleum spending, i.e. the non-oil deficit, over time.

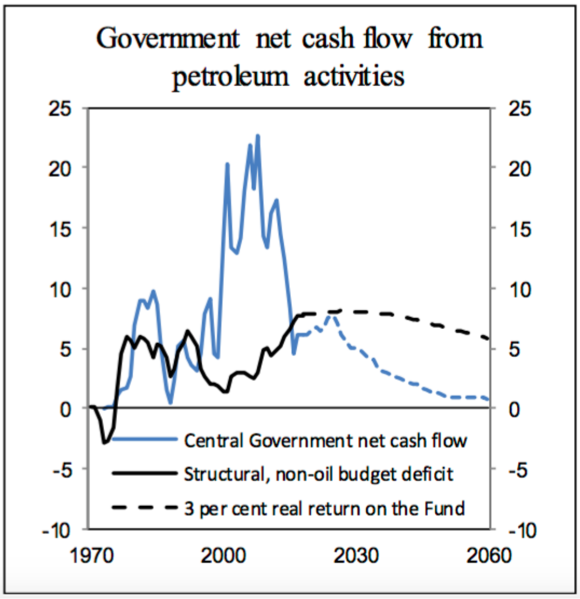


Figure 1: The State's net cash flow from the petroleum sector, the structural, non-oil deficit and 3 per cent real return on the Government Pension Fund Global. Percent of trend-GDP for mainland Norway.
Source: Norwegian Ministry of Finance (2018)

4 Estimating fiscal policy effects in SVARs

Empirical macroeconomic modelling is often undertaken in a structural VAR, a system of simultaneous equations, first introduced by Sims (1980) as an alternative to the large-scale economic models dominating at that time. It is still controversial, however, whether SVARs provide true causal inference since identification requires parameter restrictions that may be questioned. Nevertheless, the SVAR framework has been widely used in macroeconomic studies because of its simple and systematic approach, its ability of capturing rich dynamics in different time series and the easily interpretive results generated (Stock and Watson, 2001). SVAR models focus on shocks, i.e., structural disturbances or what is unexplained by the model. The relevant shocks are first identified and the structural form of the model can then be summarized by the impulse response functions and the variance decomposition. The impulse response function describes the in-sample effect of a typical shock to the system and can be used to economically interpret the systems' behavior. The variance decomposition assesses the importance of different shocks by determining the relative share of variance that each shock contributes to the total variance of each variable (Bjørnland and Thorsrud, 2014). These properties are useful for our research question.

SVARs have been used extensively to analyze the effects of monetary policy. Because of the belief that fiscal policy should not be used as a stabilization tool, there was for a long time not many researchers concerned with fiscal policy. This changed with the seminal paper of Blanchard and Perotti (2002). Since then, and especially post the financial crisis, papers examining the short term effect of fiscal policy has been rapidly growing. Most empirical studies have found estimates of modest, but positive multipliers in aggregate data, often below one (Ramey and Zubairy, 2018). That being said, the magnitude and the timing of the effects depend on identification strategy, as well as sample period, the state of the economy and country characteristics. Two main strategies have been employed to identify fiscal policy shocks:[7] Recursive restrictions and narrative methods. Alternative methods are, among others, sign restrictions and the proxy SVAR. In the following we present the different identification strategies as well as empirical evidence from recursive and narrative studies.

[7] A fiscal shock is a surprise change fiscal policy, or unanticipated news about fiscal changes that is not induced by the current state of the economy. Since the shock is by definition independent of the business cycle, we are not interested in the shock in itself when studying discretionary fiscal policy. However, it is common to assume that exogenous discretionary fiscal policy have similar effects as endogenous discretionary policy. Fiscal shocks are therefore informative about the potential stabilization role of countercyclical fiscal policy (Fatás and Mihov, 2012).

4.1 Recursive restrictions

The Choleski Decomposition is the most common way of identification in macroeconomics (Ramey, 2016). Policy shocks are identified through normalization and recursive restrictions on the contemporaneous relationship between the models' variables (see 5). The so-called SVAR approach is a more general recursive method, but it nests the Choleski Decomposition (Ramey, 2016). In addition to the zero-restrictions, other parameters are restricted by using information on e.g. elasticities of spending and taxes to output.[8] Blanchard and Perotti (2002) argue that SVAR models are indeed better suited to study fiscal policy than monetary policy since output stabilization is rarely the main reason for budget variables to change. Also, due to the lags in fiscal policy, there is little or no discretionary response of fiscal policy within a short period of time, for example within a quarter. This observation is the key to identification. In particular, they assume that government spending does not respond to the contemporaneous changes in taxes or output. While decision lags facilitate identification of fiscal shocks, implementation lags could complicate the identification since it opens the possibility for private agent's fiscal foresight. Leeper et al. (2008) and Mertens and Ravn (2010) shows that if fiscal foresight is ignored, it can lead to a non-fundamental moving average representation. This means that the true fiscal shocks will not be identified and the impulse responses will be biased. To what extent estimated fiscal shocks are anticipated and how much it matters is an empirical question (Perotti et al., 2007). Many studies suggests that households do in fact react to anticipated changes, see e.g. Ramey (2011b) and Mertens and Ravn (2012).

The recursive approach generally finds that government spending causes a shift in labour demand, consistent with many New Keynesian models (Perotti et al., 2007). Blanchard and Perotti (2002) find a multiplier close to 1 for US government purchases. Also consumption and real wages increase. Fatás and Mihov (2012) and Galí et al. (2007) found similar results. Perotti (2004a, 2007) shows that the multiplier varies from -2.3 to 3.7 between the five OECD countries he examines. He also discovers that the fiscal multiplier has become weaker over the last 20 years of his sample; the proposed reasons are monetary policy responses and that the economies have become more open. This is supported by Ilzetzki et al. (2013) who discover that both openness and a flexible exchange rate regime reduce the multiplier. In particular, countries with a flexible exchange rate regime have multipliers close to zero while countries with a fixed exchange rate have a non-zero multiplier. The main difference between the responses is in the degree of monetary accommodation to fiscal shocks. They

[8] See Perotti et al. (2007) for computation of such elasticities

also show that the multipliers are small in countries with public debt and a low level of development.

4.2 Narrative methods

The narrative approach involves constructing a series from historical documents (Ramey, 2016). For fiscal policy this was first done by Romer and Romer (1989) who extended the event study methodology developed by Ramey and Shapiro (1998). The method has mostly been used to examine the US economy. Ramey and Shapiro (1998) and Ramey (2009) construct dummies that capture dates of exogenous increases in government defence spending. Narrative records have also been applied for legislated tax changes, as in Romer and Romer (2010). Ramey (2011b) argues that the narrative approach shocks appear to capture the timing of the news about future changes in fiscal variables better than other approaches. She shows that these shocks in fact Granger-cause the VAR shocks.[9] The disadvantage of the strategy is that it could easily suffer from the small sample problem. Also, the narratively identified shocks are not necessarily exogenous. If the series include fiscal consolidations of different implications, the series cannot be used to establish a causal effects (Ramey, 2016). Moreover, narrative records often require quite extensive data gathering.

The narrative identification typically finds that during episodes of large increases in (defense) spending, output increases but private consumption and the real wage falls, consistent with many neoclassical models (Perotti et al., 2007). Ramey (2009), building on Ramey and Shapiro (1998) finds a multiplier close to 1. Using a similar methodology, Barro and Peters (2009) find a 0.5 multiplier. Ramey (2011b) estimates government spending multipliers in the range from 0.6 to 1.2. Ramey and Zubairy (2018) discovers that fiscal multipliers do not differ much between good and bad times. They estimate multipliers below unity irrespective of the amount of slack in the economy. They argue that this does not dispute the belief that government spending during WWII lifted the economy out of the Great Depression. Instead they argue that the government spending helped lift the economy out of the Great Depression because the amount of government spending was so great, not because multipliers were so large. They also investigate whether multipliers are higher at the zero lower bound, and get mixed results. For some of their specifications, however, they estimate multipliers as high as 1.5.

[9]Granger causality measures whether one event happens before another and helps predict it.

4.3 Sign restrictions

The sign restriction approach was developed by Uhlig (2005) and applied to fiscal policy analysis by Mountford and Uhlig (2009) and Pappa (2009). The strategy seeks identification by restricting the shape of the impulse response functions, which is often regarded as more theoretical than the recursive approaches since the restrictions can be made consistent with the theory that is used to interpret the results (Mountford and Uhlig, 2009). Anticipation effects is typically addressed by not letting the fiscal variable in question respond for a given amount of quarters, and then rise for a defined period afterwards. The drawback is that prior information upon the qualitative responses of the variables could be of a limited use, given the diverse competing theoretical predictions (Hebous, 2011). Moreover, the sign restriction approach does not imply unique identification; there could be many impulse responses that satisfy the specific sign restriction imposed (Aastveit et al., 2015).

4.4 Proxy SVARs

The proxy SVAR was developed by Stock and Watson (2012) and Mertens and Ravn (2013). The approach takes advantage of information developed from “outside”the VAR, i.e. external instruments such as narrative evidence, shocks from estimated DSGE models, or high frequency information. Stock and Watson (2012) developed the method to generally incorporate shocks from various external series into the VAR model. Mertens and Ravn (2013) on the other hand, focused on incorporating proxies for tax shocks into the SVAR with narratively identified tax changes. Mertens and Ravn (2014) show that the proxy SVAR can be used to reconcile the differences between structural VAR and narrative estimates of tax multipliers. According to Ramey (2016) the proxy SVAR is “a promising new approach for incorporating external series for identification.” The main challenge is to find a proper instrument: The proxy must satisfy both the relevance- and exogeneity condition. The first condition states that the instrument must be contemporaneously correlated with the structural shock of interest. The exogeneity condition makes sure that the proxy is not contemporaneously correlated with any remaining structural shocks (Mertens et al., 2018).

5 Empirical Analysis

5.1 Choice of identification approach

We use the Choleski technique rather than alternative identification strategies because neither the narrative- nor sign restriction approaches serve the purpose of our thesis. The military buildup approach is not relevant and officially available historical data does not allow us to detect a valid narrative series for government expenditure shocks. Building a narrative record for legislated tax changes by reading government budget documentaries would be interesting, but does not fit our purpose since our main focus is government spending. We do not want to restrict the responses with sign restrictions since we are in fact interested in the signs of the shocks per se (see 4.3). We also argue that the identification restrictions needed to employ the recursive method in our case are reasonable (see 5.2.3). Moreover, the recursive strategy is frequently used in the literature. This makes our results comparable to other studies. In section 6.2 we employ the proxy SVAR. In the following, the steps from a reduced-form VAR to a SVAR model employing Choleski decomposition are explained.

5.1.1 Choleski Decomposition

A VAR model of order p can be written as an extended form of normal AR(p) model (following Bjørnland and Thorsrud (2014)):

$$y_t = \mu + A_1 y_{t-1} + A_2 y_{t-2} + ... + A_p y_{t-p} + e_t \tag{1}$$

where y_t labels a (k x 1) vector of our independent variables, μ denotes a vector of constant terms and A_p is a (k x k) coefficient matrix capturing the effects of unit shocks in the endogenous variables after p periods. The vector e_t contains elements that are white noise with a positive semi-definite variance/covariance matrix $\sum_e$.

Equation (1) can be rewritten as:

$$A(L) y_t = \mu + e_t \tag{2}$$

where $A(L) = I - A_1 L^1 - A_2 L^2 - ... - A_p L^p$.

Under the assumption that our VAR(p) is stable or A(L) is an invertible matrix, we can multiply with $A(L)^{-1}$ to get the reduced form Moving Average

(MA)representation:

$$y_t = v + B(L)e_t = v + \sum_{i=0}^{\infty} B_i e_{t-i} \tag{3}$$

where $B(L) = A(L)^{-1}$ and $v = A(L)^{-1}\mu$.

Following Lütkepohl (2005), the reduced form VAR can be estimated with conventional estimation techniques. However, the reduced-form error terms in e_t are likely to be mutually correlated since the matrix $\sum_e$ is likely not a diagonal matrix, making structural interpretation impossible. To perform policy analysis, we need to make the shocks orthogonal. The most common way to do so is through the Choleski decomposition. Assume the covariance matrix of reduced-form error terms can be written as the product $\sum_e = PP'$, where P is a lower triangular matrix with positive diagonal elements. Using this, equation (3) can be rewritten as:

$$y_t = v + \sum_{i=0}^{\infty} B_i P P^{-1} e_{t-i} = v + \sum_{i=0}^{\infty} \Theta_i \epsilon_{t-i} = v + \Theta(L)\epsilon_t \tag{4}$$

where $\Theta_i = B_i P$, $\Theta(L) = \Theta_0 + \Theta_1 L^1 + \Theta_1 L^1 + \Theta_2 L^2 + ...$ and $\epsilon_{t-i} = P^{-1} e_{t-i}$. The shocks in equation (4) are now uncorrelated given that P is a lower triangle matrix because their covariance matrix is an identity matrix:

$$E(\epsilon_t \epsilon_t') = E(P^{-1} e_t e_t' (P^{-1})') = P^{-1} P P^{-1} (P^{-1})' = I$$

It is important to note that $\Theta_0 = B_0 P = IP = P$ is a lower triangle matrix and there is no restriction for the periods following. In other words, the Choleski decomposition restricts the contemporaneous structural relationships between the shocks and the variables. Particularly, each variable can have impact on all the variables ordered afterwards, but only with a lag and the variable placed on the top is affected contemporaneously only by the shock to itself.

The general reduced-form VAR(p) expressed by equation (1) can be extended to a VAR with exogenous variables:

$$y_t = \mu + A_1 y_{t-1} + A_2 y_{t-2} + ... + A_p y_{t-p} + C_0 x_t + C_1 x_{t-1} + ... + C_q x_{t-q} + e_t \tag{5}$$

or

$$A(L) y_t = \mu + C(L) x_t + e_t$$

where the x_t denotes a (l x 1) vector of l exogenous variables, C_t is a (k x l) coefficient matrix contains the elements representing the effect of the exogenous variables on the endogenous variables and $C(L) = C_0 + C_1L^1 + C_2L^2 + ... + C_qL^q$.

Following similar steps from reduced-form VAR to SVAR, we can get the structural moving average model associated with the reduced-form VAR above:

$$y_t = v + \Theta(L)\epsilon_t + \Omega(L)x_t \tag{6}$$

where $\Omega(L) = B(L)C(L)$.

5.2 Model specification

5.2.1 Choice of variables

Our SVAR model is composed of four endogenous variables: Government oil revenue (oilrev), a fiscal variable (F), gross domestic production (GDP) and the interest rate (i). F can be government expenditure (G), the change in structural non-oil deficit (DEF), or public employment (PE). We will try them one after each other, in three different model specifications.

To account for the fiscal spending rule we include oil revenue in our model (oil revenue Granger causes the structural non-oil deficit, see A.2). According to the rule, approximately 4% of the GPFG has been phased into the Norwegian economy each year. Hence, what we are capturing is the growth in oil revenue, above or below the average growth. We note that using the oil revenue has its disadvantages since only a share of the revenue is spent every year. We could therefore capture effects of what is saved. However, we do not expect this saving to have a significant effect on the development of the fiscal variables (but in any case, the data will decide). What we are interested in analyzing is whether there is a steady and significant relationship between changes in the oil revenue and fiscal policy. Our hypothesis is that there will be such a relationship due to the systematic phasing-in of oil revenue into the economy each year. We could alternatively have used the oil price, but that would not have been as good of a proxy for the fiscal spending rule as oil revenue (still we do try this in 7.2). Using the structural non-oil deficit would be a second alternative, but because of its high correlation with the fiscal variables (see appendix A.1) this would not be feasible in the SVAR framework.

In addition to the oil revenue, we choose to study three fiscal variables in three separate specifications as all three variables are important for Norwegian fiscal policy. Since the degree of fiscal expansion is measured by the structural non-oil deficit as percentage of Norwegian trend mainland GDP (deficit for short), it is natural to assess the effect of discretionary fiscal policy using this variable.

This specification will therefore be our main model specification (for which we later carry out sensitivity analysis). Because public employment accounts for a high percentage of public spending in Norway (see 1) we are interested in examining the effects of a shock to this variable. Finally, we are interested in the effects of government expenditure in general. Also, government expenditure is the most commonly used fiscal variable in the literature (when not looking at tax). Including all three fiscal variables in one FAVAR[10] model could be an alternative approach, but that is above the scope of this thesis. Running separate specifications for different fiscal variables is a good alternative since it facilitates an assessment of how each variable react to an oil revenue shock as well as the effects of the different fiscal shocks.

The interest rate is added to our SVAR because the effect of fiscal policy depends greatly on the interaction with monetary policy. Most empirical studies have examined monetary- and fiscal policy in separation. Yet, some studies demonstrate the importance of considering monetary- and fiscal policy shocks together in the SVAR to avoid attributing fluctuations to the wrong source, see Davig and Leeper (2011) and Rossi and Zubairy (2011).

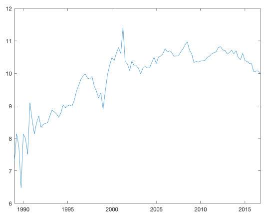
We include OECD production (OECD) as an exogenous variable to control for the impact of global activity on the system of interest. We make sure that none of the variables in our SVAR model Granger causes OECD production (see appendix A.2).

5.2.2 Data description

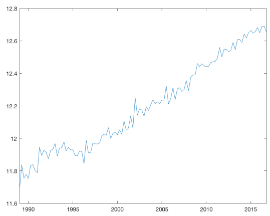
All variables are in logs except for the interest rate. OECD production is log-detrended. Inflation effects are taken out of the data by using real terms of GDP, oil revenue and government expenditure. The latter two variables are constructed from a nominal series deflated with Norwegian CPI. In addition, since the change in the non-oil deficit is only available on yearly basis, we construct the quarterly series ourselves. This is done under the assumption that the relative value of the deficit in a quarter to the year value is the same as the relative value of real government expenditure in that quarter to a year. See a full description of the data in Appendix A.3.

We use quarterly data from 1989Q1 to 2016Q4. The sample reflects the longest possible time for which a full panel of observations is available and the oil revenue is positive. The data is plotted below.

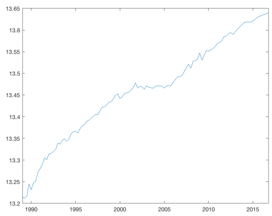
[10]Factor-Augmented Vector Autoregressive



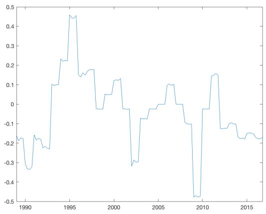
(a) Log of real oil revenue



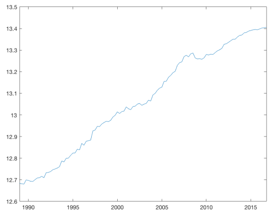
(b) Log of real government expenditure



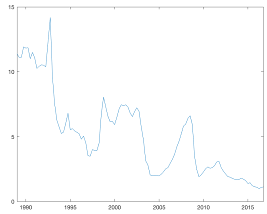
(c) Log of public employment



(d) Change in structural non-oil deficit



(e) Log of real mainland GDP



(f) Interest rate NIBOR

Figure 2: Plot of data

Figure 2 displays upward trends in government spending, public employment as well as oil revenue. This is not surprising considering the fact that the funds value (and the return from the fund) has grown extensively throughout our sample period. This has allowed the government to continue to run a higher non-oil structural deficit (in absolute value). Both total government expenditure and public employment have increased throughout the same time period. To account for this, we allow for an intercept and a trend inside the VAR.

5.2.3 Identifying assumptions

The following structural moving average is estimated for our SVAR:

$$\begin{bmatrix} oilrev_t \\ F_t \\ GDP_t \\ i_t \end{bmatrix} = v + \alpha t + \begin{bmatrix} \theta_{11,0} & 0 & 0 & 0 \\ \theta_{21,0} & \theta_{22,0} & 0 & 0 \\ \theta_{31,0} & \theta_{32,0} & \theta_{33,0} & 0 \\ \theta_{41,0} & \theta_{42,0} & \theta_{43,0} & \theta_{44,0} \end{bmatrix} \begin{bmatrix} \epsilon_{oilrev,t} \\ \epsilon_{F,t} \\ \epsilon_{GDP,t} \\ \epsilon_{i,t} \end{bmatrix} + lags + \Omega(L)OECD_t \tag{7}$$

Oil revenue is placed first under the assumption that it is predetermined with respect to other macroeconomic variables in the system. The fiscal variable is ordered next, above GDP since we assume that it requires at least one quarter for fiscal authorities to respond to output shocks following Blanchard and Perotti (2002) and others.[11] The fiscal variable is placed below oil revenue

[11] A possible objection is that the national budget is decided on a yearly basis. One could therefore argue that there is in reality only one fiscal shock every year. However, it is unrealistic to assume that it takes a whole year for policymakers to respond to output shocks (Ilzetzki et al., 2013). In Norway, the national budget is not fixed for the entire

as we assume that fiscal policy F_t can be explained by the following equation:

$$F_t = f(lags\ of\ macro\ variables) + \alpha * oilrev_t + \beta * \epsilon_{F,t}$$

That is, because of the fiscal spending rule (see 3.2) oil revenue can affect the fiscal variable contemporaneously, but the macro variables affect fiscal policy with a lag. The interest rate is placed at the bottom of the system since macroeconomic theory implies that monetary policy affects GDP with a lag (Svensson, 2000).

Choosing an appropriate number of lags is essential in SVAR analysis. Including too many lags relative to the number of observations may result in poor and inefficient estimates of the coefficients, while using too short lag order will imply that the model is misspecified, and the OLS esimates will be biased (Bjørnland and Thorsrud, 2014). For our model, AIC and SBIC suggest different lag lengths for each specifications and for different specifications of different fiscal variables. SBIC tends to choose only one or two lags while the result varies when it comes to AIC suggestions. As pointed out by DeSerres et al. (1995), applying the information criteria usually leads to too short suggested lag length. According to Hamilton and Herrera (2004) among others, a large number of lags are needed to capture the dynamics in the oil-macro relationship. Therefore, we include four lags of the endogenous variables. By choosing the same lags for different specifications instead of using the AIC or SBIC suggestion, it can be assure that the differences in results across specifications are not caused by differences in the number of lags.

year but revised once a year instead. Higher frequency than annual data is therefore required.

6 Discussion of results

We here present the results from the three different specifications of our SVAR. We first interpret the impulse responses of the different fiscal variables and output to a shock to oil revenue. Then we discuss the effects of fiscal policy on mainland GDP through the different fiscal variables. Lastly we present results generated with the proxy SVAR and a SVAR model extended with the FNI.

6.1 Results from the SVAR

6.1.1 Effects of an oil revenue shock

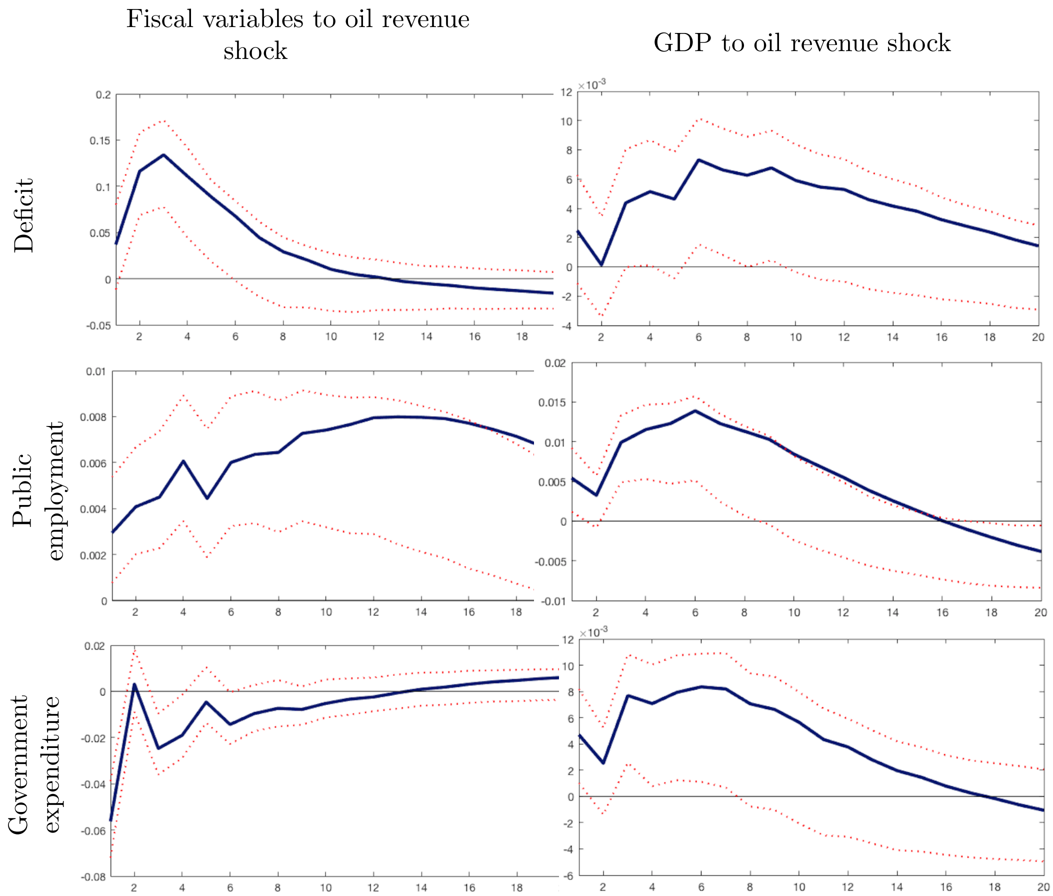


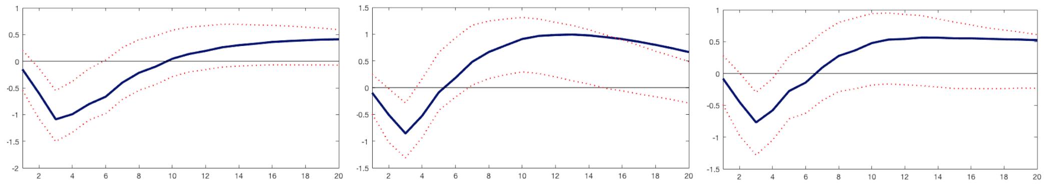
Figure 3: Impulse responses to an oil revenue shock generated from the three SVAR specifications, including OECD production as an exogenous variable as described in equation 7. Shocks are normalized to unit shocks, i.e. 1%. The areas between two red dotted lines represent 68% confidence bands calculated using a bootstrap with 2000 draws.

Figure 3 presents the effects of a positive shock to oil revenue on the fiscal variables (left column) and mainland GDP (right column). We discuss the results in that order. Note that each row is a different model specification.

Both public employment and the deficit increase significantly on impact in response to the oil revenue shock, though the effect to public employment is much more persistent. Both responses indicate that fiscal spending increases procyclically with oil revenue. From the variance decomposition (see table 1) we see that a shock to oil revenue explains 12.45% of the variance in the deficit and 13.06% of the variance in public employment after two years. Since mainland GDP also increases following the oil revenue shock (see the left column and discussion below), our results imply that deviations from the fiscal spending rule are not adopted countercyclically over the business cycle, at odds with the aim of the fiscal guidelines. This might not be surprising considering that, in accordance with the spending rule, a fixed share of a growing wealth fund has been spent every year. This procyclical behavior is in line with the findings of Bjørnland and Thorsrud (2016). They show that fiscal policy has been procyclical to the price of oil despite the adoption of the fiscal spending rule. They argue that spending a fixed percentage over a growing fund each year will simply not be countercyclical enough over the commodity price cycle. Based on this, and the high positive correlation between the price of oil and oil revenues (see appendix A.1) it indeed seems reasonable that we find fiscal spending to have increased with oil revenues during our sample period.

Following a positive innovation to oil revenue, government spending decreases on impact, implying that general government spending is predetermined rather than elastic to the variance in oil revenue. Nevertheless, the effect is close to zero and insignificant from the second quarter.

For all specifications, mainland GDP increases on impact following a sudden increase in oil revenue. For the specifications with government spending and public employment, this result is positive and significant from the third until the eight quarter. Oil revenue shock explains respectively 16.65%, 4.10% and 6.66% of the variance in GDP for the specification with public employment, deficit and government spending after eight quarters (see table 1). The impulse responses results implicate that there are no crowding out effects in the short run. Instead it seems to be spillover effects from the oil sector to the mainland economy. We obviously do not know whether the shock to oil revenue is associated with increased oil production or a spike in the price of oil. In any case, Bjørnland et al. (2018) discover that a resource boom resulting from increased oil activity, also increases productivity significantly in other industries, including manufacturing. That is, they show that the resource sector can in fact be an engine of growth, at odds with the predictions of the standard Dutch disease theory.[12] They find no such productivity spillovers following an oil price shock. Research by Bergholt et al. (2017) however, show that oil price shocks to not crowd out manufacturing output, despite a rather strong exchange rate appreciation. Based on both of these findings, it seems reasonable that a positive shock to oil revenue in fact has a positive short-run effect on mainland GDP.



Specification with deficit | Specification with public employment | Specification with government expenditure

Figure 4: Impulse responses of interest rate to oil revenue shock generated from the three SVAR specifications, including OECD production as an exogenous variable as described in equation 7. Shocks are normalized to unit shocks, i.e. 1%. The areas between two red dotted lines represent 68% confidence bands calculated using a bootstrap with 2000 draws.

The interest rate drops on impact, but then increases, in all three specifications in response to an oil revenue shock. The increase is not surprising given the inflation targeting framework in Norway. As discussed above, a positive oil revenue shock in general leads to significant rise in mainland GDP. To counteract the inflation pressure caused by increased oil revenue, the central bank will typically tighten monetary policy, as indicated by a rise in the interest rate. The interest rate decreases on impact, however. This could be due to the implementation lag in monetary policy.[13]

6.1.2 Effects of a fiscal shock

Figure 5 presents the effects of the three fiscal variables on output in the corresponding specifications. Fiscal multipliers are positive and below unity for all cases. This is in line with most other empirical studies (see 4). The hump-shape impulse response is similar to other findings, see e.g. Galí et al. (2007)

[12]They develop a dynamic three sector model that incorporates the productivity dynamics from both the spending- and the resource movement effect. This alters the conclusions from earlier models of LBD and the Dutch disease, which focus on the spending effect. They argue that the resource movement effect suggests that the growth effects of natural resources are likely to be positive. The reason is that value added per worker is increasing with an oil boom, as there is learning by doing also in the oil service industries. Since there is LBD in the oil related industries as well, these industries also experience increased productivity effects.

[13]We do not focus on the effects of monetary policy in this thesis, but we note that GDP reacts as expected (decreases significantly) following a positive shock to monetary policy, see Appendix A.4.

and Mertens and Ravn (2014). For instance, Galí et al. (2007) finds that it takes two years for a government spending shock to have the maximum effect on output. The effect is less persistent in the specifications with public employment and government expenditure. This could be due to a pro-cyclical interest rate effect that amplifies the increase in aggregate demand, as can be seen in the impulse response functions in the right column of figure 5. Only after some periods, when monetary policy has reacted to changes in inflation, the effects of the government expenditure shock die out (Bonam et al., 2017).

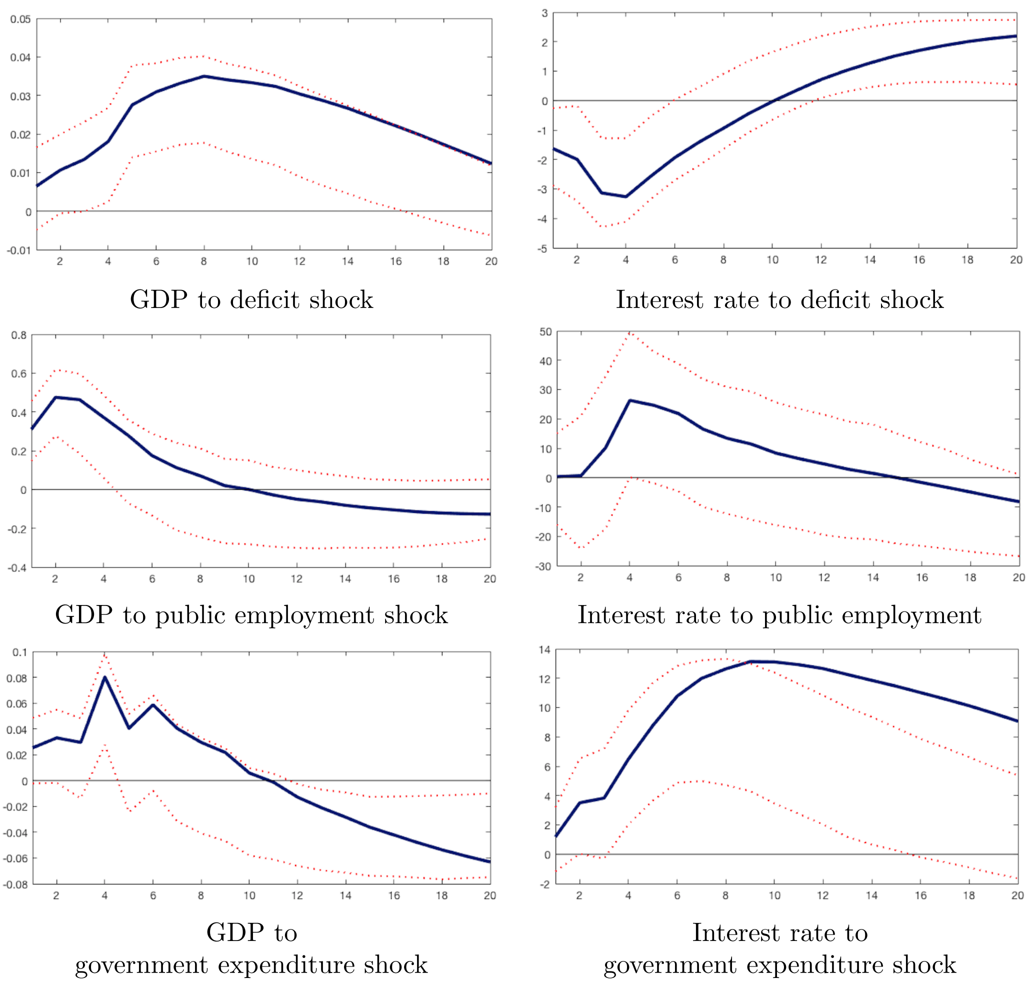


Figure 5: Impulse responses of GDP and interest rate to fiscal shocks generated from the three SVAR specifications, including OECD production as an exogenous variable as described in equation 7. Shocks are normalized to unit shocks, i.e. 1%. The areas between two red dotted lines represent 68% confidence bands calculated using a bootstrap with 2000 draws.

Following a deficit shock, the GDP response is persistent and significant, though not significant in the beginning. Hence, a fiscal expansion measured by the deficit seems to have a small positive effect on the Norwegian economy, implying a small positive fiscal spending multiplier. In particular, the maximum effect on GDP is 0.0350% in the eight quarter, implying a multiplier of 0.0350. We see from the variance decomposition (see table 1) that the non-oil deficit shock explains 15.38% of the variance in GDP.

The effect is bigger and more significant following a positive shock to public employment. In particular, a 1% initial increase in public employment results in a maximum of 0.4750% increase in GDP, which corresponds to a multiplier of 0.4750. Shock to public employment explains up to 12.18% of the variance in GDP (see table 1). Similar results can be found in e.g. Linnemann (2009) and Caponi (2017) where it is shown that a positive shock to public employment is likely to lead to a temporary increase in real output and private sector employment.

Following a positive innovation to government expenditure, output increases significantly on impact, reaches a peak four quarters out and then starts falling in the sixth quarter, though the response is no longer significant. In particular, a 1% initial increase in government spending results in a maximum of 0.0802% increase in output in the end of year 2, equivalent to a government spending multiplier of 0.0802.

The positive, yet modest multiplier effects (below unity) found in all specifications are in line with most previous empirical studies (see 4). As discussed in section 2.3, multipliers below one indicates that the effect on GDP is not big enough to cover the deficit associated with the fiscal expansion. The modest effects are not surprising considering the fact that Norway is a small open economy with a floating exchange rate regime. These features typically reduces the multiplier (see 4.2 and Box 1). The multipliers we have calculated here might also be larger than what we could have found employing the cumulative method (see 2.3).

Variable and horizon	Shocks			
	Oil revenue 4, 8	DEF/PE/G 4, 8	GDP 4, 8	Interest rate 4, 8
DEF specification				
Oil revenue	96.19, 83.80	1.52, 7.44	1.08, 2.00	1.21, 6.77
Deficit	11.31, 12.45	87.13, 77.87	1.00, 2.81	0.56, 6.87
GDP	1.77, 4.10	3.79, 15.38	91.43, 73.48	3.01, 7.04
Interest rate	6.29, 5.98	11.15, 10.48	3.42, 14.64	79.13, 68.90
PE specification				
Oil revenue	94.40, 89.69	2.38, 2.59	1.87, 6.37	1.36, 1.35
Public employment	8.08, 13.06	84.70, 77.55	3.35, 5.63	3.88, 3.77
GDP	9.63, 16.65	12.18, 7.58	73.59, 59.38	4.60, 16.39
Interest rate	3.27, 3.49	1.03, 2.07	0.42, 4.51	95.28, 89.93
G specification				
Oil revenue	96.99, 92.76	1.21, 4.28	0.81, 1.65	0.99, 1.31
Government expenditure	13.66, 12.52	81.95, 76.13	0.40, 0.66	3.99, 10.68
GDP	4.57, 6.66	6.37, 6.07	84.21, 71.32	4.85, 15.95
Interest rate	3.00, 1.96	3.96, 17.93	1.17, 11.06	91.87, 69.04

Table 1: Variance decomposition (in percentages) of different variables for time horizons 4 (left) and 8 (right), generated from the three SVAR specifications

6.2 Proxy SVAR

We here give a brief introduction to the proxy SVAR following Lunsford (2015) and present the result from using oil revenue as a proxy for the deficit.

Recall the reduced form VAR expressed by equation 1. In our Proxy SVAR model, Y is a (3 x 1) vector:

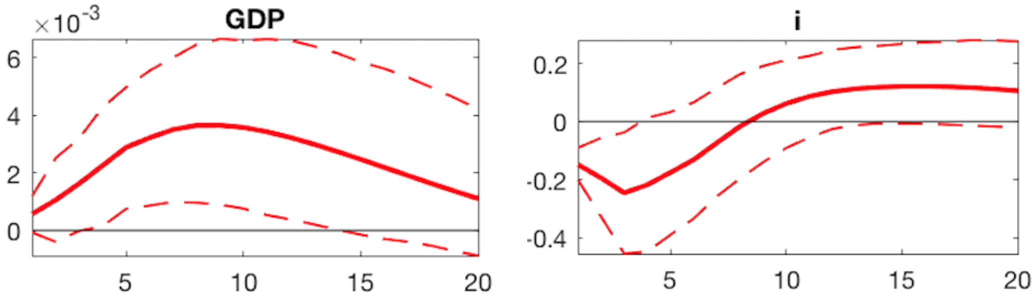
$$Y_t = (DEF, GDP, i)'$$

and the vector of structural shocks ϵ_t is related to reduced form VAR by:

$$e_t = Q\epsilon_t$$

where Q is a (3 x 3) matrix.

Our interest is the estimation of coefficients in Q that corresponds to the structural fiscal shock. These parameters, according to the order of variables in Y_t, form the first column of Q, let say Q_1. In order to estimate Q_1, restrictions need to be imposed in the elements in Q. Instead of using Cholesky decomposition, we here employ an alternative approach. That is, we use an instrument for the non-oil deficit shock. The instrument is considered to be a good proxy if it fulfills both the exogeneity and the relevance condition (see 4.4). In this paper the proxy SVAR serves only as an alternative for our SVAR model; therefore, the strength of the external instrument will not be evaluated thoroughly.



GDP to deficit shock | Interest rate to deficit shock

Figure 6: Impulse response of GDP and interest rate to deficit shock generated from Proxy SVAR model where oil revenue is used as proxy. Shock is normalized to unit shocks, i.e. 1%. The areas between two red dotted lines represent 90% confidence bands calculated using a bootstrap with 2000 draws

Figure 6 shows the response of GDP to a deficit shock. Following an unexpected increase in the deficit, GDP increases on impact and is significantly positive after the second quarter. This supports our findings of a positive and modest fiscal multiplier effect in 6.1.2. In addition, the impulse response function of the interest rate yields an almost identical shape as the function found in our main model. The similar results from the two different identification strategies supports the findings from our SVAR model.

6.3 Fiscal foresight and the FNI as a potential solution

Failing to identify and quantify the effects of foreseen fiscal changes could lead to biased impulse responses (see 4.1). The principal methods for dealing with anticipation effects are measuring expectations directly, time series restrictions or theoretical model restrictions (Ramey, 2016). News have typically been incorporated into VARs is by adding the news series to a standard VAR, and ordering it first. In Perotti (2011) these are called Expectational VARs (EVARs). For instance, Beaudry and Portier (2006) used information about future technology shocks from stock prices while Ramey (2011a) read Business Week and other newspapers and created a series of news bout future government spending. Haug et al. (2013) construct a narrative series for discretionary fiscal policy by reading Polish government records. In the monetary policy literature, high frequency identification has been employed to address anticipation effects. According to Ramey (2016), high frequency financial futures data is ideal for ensuring that a shock is unanticipated.

Our aim in this section is to control for fiscal foresight by using a high frequency narrative news index, namely the FNI, produced by Retriever and Center for Applied Macro- and Petroleum Economics (CAMP), provided to us by CAMP. The FNI is designed to track Norwegian GDP growth and the business cycle at high frequency. Its underlying indicators are daily time series representing how much the media writes about various topics. The idea behind the index is the following. The more intensive a given topic is represented in the newspaper at a given point in time, the more likely it is that this topic represents something of importance for the economy's current and future needs and developments, under the assumption that newspapers provide a relevant description of the economy. Hence, the FNI captures the continuously evolving narrative about economic conditions, and relates this to actual GDP growth and the business cycle (CAMP). Thorsrud (2016) shows that the FNI has very good classification properties for the Norwegian business cycle. That is, it captures economic expansions and downturns well. He also shows that news topics related to monetary- and fiscal policy, the stock market and credit, and industry specific sectors seem to provide the most important information about daily business cycle conditions.

The Government FNI comes from the paper "The Value of News" (Larsen and Thorsrud, 2015) where a major business newspaper is decomposed according to the topics it writes about. It is shown that the topics have predictive power for key economic variables. One of the topics related to fiscal policy is "government". The top words associated with the Government FNI used in this thesis are: suggestions, parliamentary, department, Ministry of Finance, selection, treasury, minister, change, stream, budget, Ministry of finance, national budget. Based on this, we could expect that the index capture news about important fiscal spending decisions. An obvious challenge, however, is that is also captures other things.

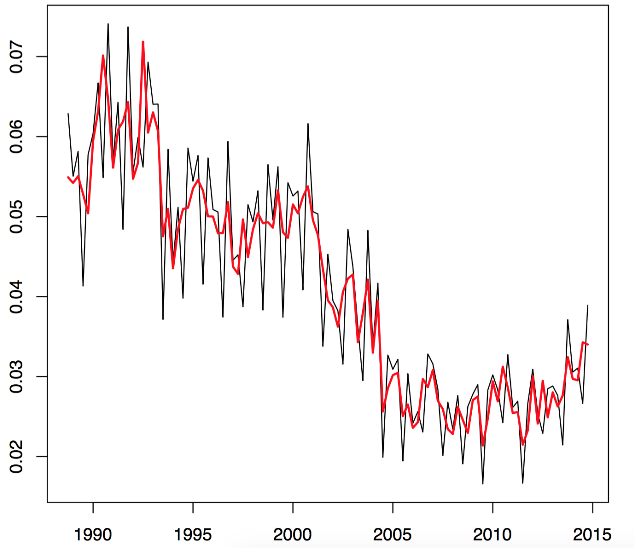
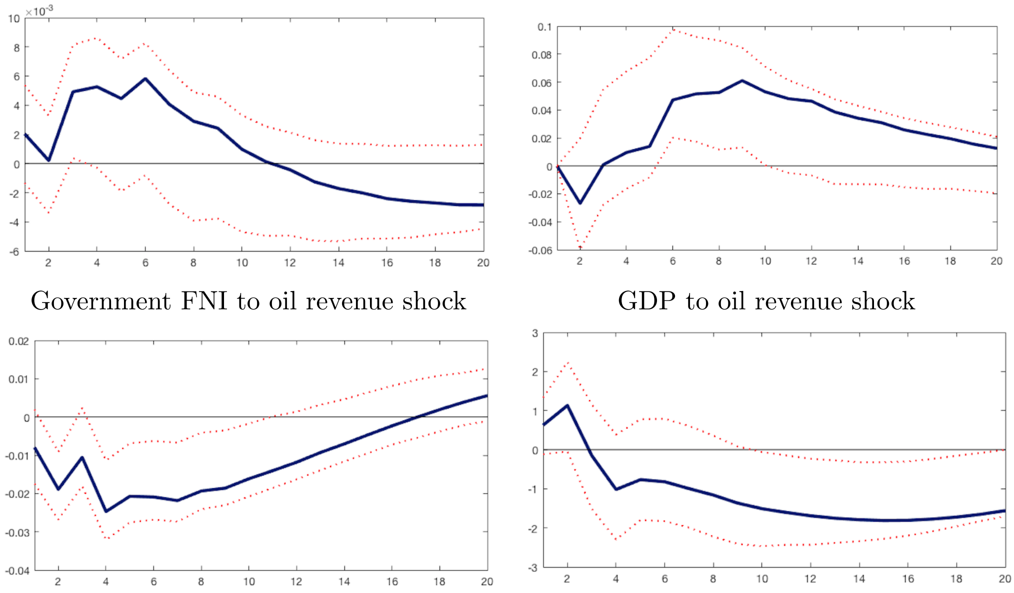


Figure 7: Original and adjusted government FNI time series. We seasonally adjust the series in R. The R-package provides an a wrapper around the X-13 ARIMA-SEATS Fortran libraries provided by the US Census Bureau.

We take the FNI into account by running a modified version of our SVAR model in a shorter sample period (1989Q1 - 2014Q4) due to lack of government FNI data. The government FNI is used instead of the fiscal variable F and placed on the top of the SVAR system under the assumption that news is not affected contemporaneously by any macro variables. Figure 8 shows the impulse responses generated. Though the economic literature utilizing textual information and alternative data sources is growing rapidly, it is still in its early stages (Thorsrud, 2016). Therefore, there is no clear benchmark for us to test if the use of the FNI and the result generated are accurate.

The government FNI goes up in response to a positive sudden change in government oil revenue. This implies a procyclical fiscal policy if we assume that the FNI actually captures fiscal foresight, supporting the results from the specifications with public employment and the deficit. The response of GDP to a government FNI shock shows an opposite shape compared to those found in the previous section. An increase in the government FNI lowers current and short term future output. As mentioned above, since the index does not capture only news about fiscal spending, it complicates the interpretation of our result.



Government FNI to oil revenue shock

GDP to oil revenue shock

GDP to government FNI shock

Interest rate to government FNI shock

Figure 8: Selected impulse responses generated from the specification with government FNI, including OECD production as an exogenous variable. Shocks are normalized to unit shocks, i.e. 1%. The areas between two red dotted lines represent 68% confidence bands calculated using a bootstrap with 2000 draws.

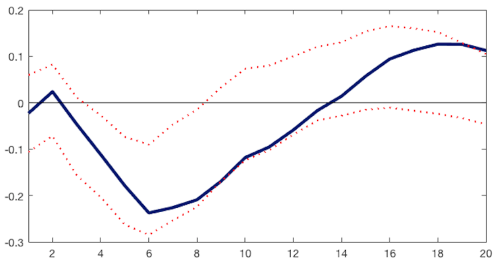
In addition, the government FNI series is not adjusted for sentiment or tone, i.e. both positive and negative context give a positive number for the index. We can therefore not draw any clear conclusions from these results. We believe that the government FNI could be a potential solution for the fiscal foresight problem. Nevertheless, to get accurate conclusions the use of the index must be processed further.

7 Robustness

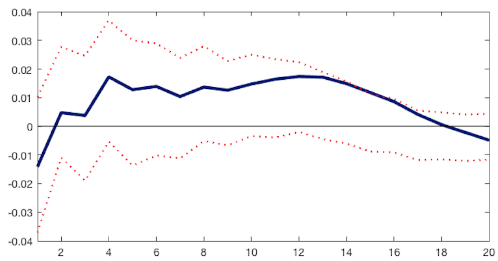
In this section we carry out sensitivity analysis for the specification with the deficit used as the fiscal variable. We check for subsample stability as well as robustness to an alternative SVAR model with the oil price as an exogenous variable. We also consider an extended version of our SVAR model adding tax, and robustness to 90 % confidence bands.

7.1 Subsample stability

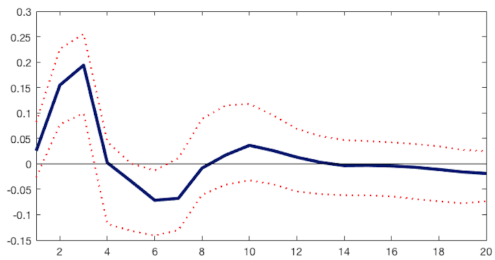
Since the fiscal framework as well as the monetary policy regime has changed over time we could expect fiscal policy to have different effects before and after the institutional changes in 2001. We therefore split the sample in two around that period: 1989Q1 - 1998Q4 and 1999Q1 - 2016Q4.



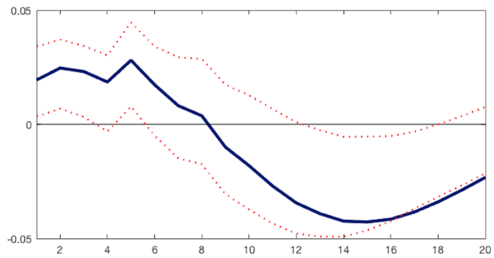
Deficit to an oil revenue shock, early sample



GDP to deficit shock, early sample



Deficit to an oil revenue shock, late sample



GDP to deficit shock, late sample

Figure 9: Selected impulse responses generated from the three SVAR specifications, including OECD production as an exogenous variable as described in equation 7. The shocks are normalized to unit shocks, i.e. 1%. The areas between two red dotted lines represent 68% confidence bands calculated using a bootstrap with 2000 draws. The sample is split into two periods: early sample (1989Q1 - 1998Q4) and late (1999Q1 - 2016Q4)

Figure 9 regards the sub sample stability of our results. Looking at the two graphs to the left, fiscal policy is clearly more countercyclical in the early sample. It should be noted that the observations for the early sample are few. In the later sample fiscal policy is more procyclical. This supports the findings of Bjørnland and Thorsrud (2016) who show that fiscal policy has been more, not less, procyclical since the adoption of the spending rule in 2001. In the early sample, however, the result implies a countercyclical fiscal policy which is at odds to what is found in Bjørnland and Thorsrud (2016). The difference can be explained by the small size of our first sub sample compared to a longer sample period starting from 1983Q1 in their paper. In addition, since we use oil revenue instead of the oil price the result may differ slightly.

The two remaining graphs show the effects of a deficit shock in the sub samples. The fiscal multiplier appears to be positive in both periods. More interestingly, we see a stronger short run multiplier in the late sample, although the effect dies out faster. A possible explanation could be that the interest rate has been lower, i.e. closer to the zero lower bound, in the later sample, which could amplify the effects of government expenditure see 2.1 and Box 1. While in the early sample, the effect is negative in the first period and insignificantly positive over the rest horizon, the impulse response and its uncertain bands are above the zero line in the first six quarters in the late sample. This indicates that the effect of fiscal policy has become greater over time.

7.2 The oil price as an exogenous variable

The oil revenue variable in our SVAR system is affected by the oil price through two channels. First, since the oil price is always one component of revenue, the oil price can affect government oil revenue directly. Second, the change in a oil price could lead to a change in oil production, and thus a change in oil revenue. In addition, it is reasonable to assume that the oil price is exogenous to the Norwegian macro variables. This is supported by the result from the Granger causality test result A.2. Therefore, in this section the exogenous variable, which is OECD production in our SVAR model is replaced by the oil price.

After controlling for the impact of the price of oil on the SVAR system, the effect of oil revenue on output is bigger and more significant. By contrast, the deficit seems to react less compared to the result found in 3. However, all impulse responses in figure 10 have the same shape as those generated from our SVAR model. Interestingly, the effect of a deficit shock on GDP is likely to remain unchanged when we change the exogenous variable. This result provides a good evidence for the robustness of our SVAR model.

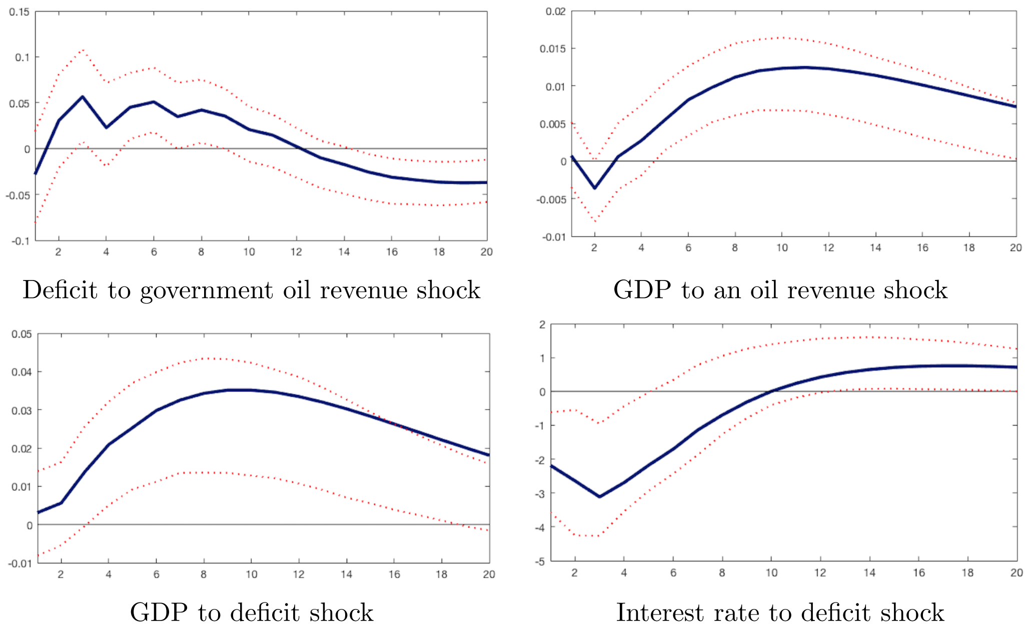


Figure 10: Selected impulse responses generated from the modified model, including log-detrended oil price as an exogenous variable. The shocks are normalized to unit shocks, i.e. 1%. The areas between two red dotted lines represent 68% confidence bands calculated using a bootstrap with 2000 draws.

7.3 Adding tax

Tax revenue (T) is added to our SVAR model to check for the robustness of the results found in the previous section. Following Blanchard and Perotti (2002) we place tax above the fiscal spending variable. The vector of endogenous variables is now (oilrev, T, def, GDP, i)'.

In this specification a positive tax shock increases GDP, at odds with the finding of Blanchard and Perotti (2002) among others. Positive tax multipliers also seem somewhat counter-intuitive. A possible explanation is that the tax shock is not properly identified, due to for instance anticipation effects (see 4.2). Positive tax multipliers are found in some studies, however, see for instance Giordano et al. (2007) and Mirdala et al. (2009). The other impulse responses shown in figure 11 have a shape similar to the corresponding result from our SVAR model although the size of the effects differ to a small extent. In particular, the effect of oil revenue on GDP is smaller on impact but almost twice as big at the peak compared to the result from our SVAR model. Similarly, the maximum increase in output following a deficit shock in the specification including tax is also significantly larger.

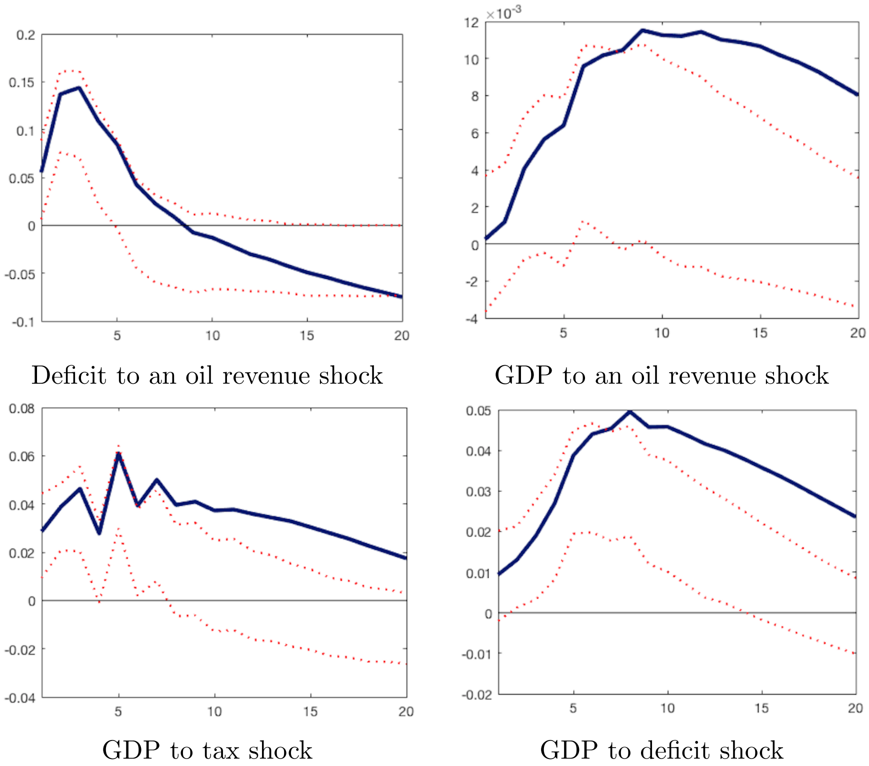


Figure 11: Selected impulse responses generated from the extended model including tax revenue with OECD production as an exogenous variable. The shocks are normalized to unit shocks, i.e. 1%. The areas between two red dotted lines represent 68% confidence bands calculated using a bootstrap with 2000 draws.

7.4 90% confidence bands

In our SVAR model, all impulse responses are shown with 68% confidence bands. In this section, 90% confidence bands are applied for the specification using deficit as fiscal variable. Figure 12 shows significant effects in all impulse responses considered, confirming the robustness of our model.

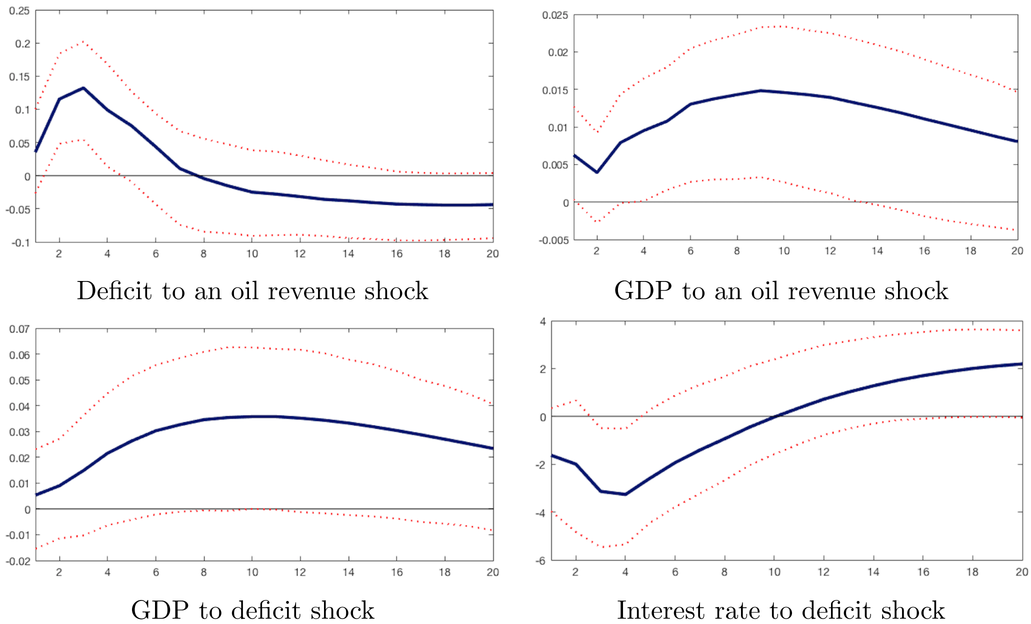


Figure 12: Selected impulse responses generated from the three SVAR specifications, including OECD production as an exogenous variable as described in equation 7. The shocks are normalized to unit shocks, i.e. 1%. The areas between two red dotted lines represent 90% confidence bands calculated using a bootstrap with 2000 draws.

8 Conclusion

In this thesis, we have investigated two matters concerning Norwegian fiscal policy. We first examined how a sudden increase in oil revenues affects mainland GDP and fiscal spending. Then we studied the effect of discretionary fiscal spending on mainland GDP. This was done through an empirical SVAR analysis. Acknowledging that the effects of fiscal policy depends on country characteristics, our SVAR model was built to fit Norway, particularly by accounting for the importance of oil in the economy. To account for monetary- and fiscal policy interactions we also added the interest rate to our SVAR. OECD was included to control for the impact of global activity. We also employed a proxy SVAR, which findings supports the results from the SVAR specifications. Finally, we aimed to control for fiscal foresight by using the FNI, a narrative news index for the Norwegian economy.

Our results make it clear that mainland GDP increases following a hike in oil revenue, and that fiscal spending has been more procyclical in our later sample. A significant part of fiscal expansion has gone into increased public employment throughout our sample period. We find that this has had a positive, yet modest, short term effect on the Norwegian economy. We show that this is also the case for discretionary fiscal spending in general. Nevertheless, the multipliers are not above unity. That is, output increases less than the increase in the fiscal expansion. This is in line with most empirical estimates of fiscal spending multipliers in aggregate data. The results are robust for different specifications of our SVAR model, as well as a proxy SVAR. The results from the specifications with the FNI are somewhat difficult to interpret since the index captures not only news about fiscal changes.

A natural extension of our study would be to better control for fiscal foresight. The government FNI could be a potential solution for the fiscal foresight problem; nevertheless, to get accurate conclusions the use of the index must be processed further. To take our analysis a step further we suggest building a narrative record to identify government spending shocks. Also, much of the literature demonstrate the importance of distinguishing between different types of fiscal policy shocks. Another suggestion for future research is therefore to build a model to identify both tax- and spending shocks.

We do not examine the medium- or long term effects of fiscal spending in this thesis. We note, however, that once a fiscal change has become effective, it is often politically difficult to reverse it. Both public sector expenditure as a percentage of mainland GDP and public employment as a share of total employment are currently among the highest in OECD; and they have increased with oil revenues throughout our sample period. According to NOU 2015:9, Norway has become more dependent on petroleum than anticipated in 2001; and the country may be spending more petroleum money than generally thought. Considering the fact that the Norwegian economy must adapt to lower demand from the oil sector in the medium term and that government oil revenues are expected to decrease, the oil dependence is a challenge. Lowering the expected real rate return of the GPFG to 3% in 2017 was therefore a step in the right direction.

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A Appendix

A.1 Appendix 1: Correlations

	Real G	Public employment	Deficit	FNI	GDP	Interest rate	Poil	Government oil revenue	OECD
Real G	100.00 %	0.46 %	-16.24 %	-3.39 %	2.91 %	-1.19 %	4.71 %	-13.43 %	-3.27 %
Public employment	0.46 %	100.00 %	4.29 %	-12.90 %	12.46 %	3.26 %	1.84 %	4.94 %	-14.19 %
Deficit	-16.24 %	4.29 %	100.00 %	-9.59 %	3.25 %	-13.19 %	4.79 %	3.86 %	19.15 %
FNI	-3.39 %	-12.90 %	-9.59 %	100.00 %	-3.44 %	3.78 %	9.61 %	3.18 %	1.78 %
GDP	2.91 %	12.46 %	3.25 %	-3.44 %	100.00 %	14.13 %	26.21 %	7.71 %	36.05 %
Interest rate	-1.19 %	3.26 %	-13.19 %	3.78 %	14.13 %	100.00 %	11.23 %	6.84 %	30.46 %
Poil	4.71 %	1.84 %	4.79 %	9.61 %	26.21 %	11.23 %	100.00 %	20.24 %	40.72 %
Government oil revenue	-13.43 %	4.94 %	3.86 %	3.18 %	7.71 %	6.84 %	20.24 %	100.00 %	16.55 %
OECD	-3.27 %	-14.19 %	19.15 %	1.78 %	36.05 %	30.46 %	40.72 %	16.55 %	100.00 %

Figure 13: Table of correlations between variables. All variables are in difference.

A.2 Appendix 2: Granger causality test

		X								
		FNI	**Real G**	**Public employment**	**Deficit**	**GDP**	**Poil**	**Government oil revenue**	**OECD**	**Interest rate**
Y	**FNI**	0.0000	1.3872	1.3785	0.5345	0.4157	0.3411	0.4020	0.3213	***2.5275***
	Real G	0.9031	0.0000	1.0385	1.8722	1.2901	1.8471	1.1475	0.9866	0.7496
	Public	0.6245	0.6703	0.0000	***2.4067***	***2.2129***	1.0316	0.8474	1.1219	0.6645
	Deficit	0.5947	0.4539	0.4275	0.0000	0.6422	0.5986	0.6115	0.4833	0.7443
	GDP	0.9803	1.7325	1.4525	1.1922	0.0000	1.8487	1.6608	2.0132	1.3857
	Poil	1.1142	1.3468	1.2070	***4.6693***	1.0569	0.0000	1.5973	***4.5734***	1.9324
	Government oil revenue	0.9115	***3.0227***	1.6489	***2.3609***	0.6030	0.6545	0.0000	1.2759	0.6712
	OECD	1.4269	***2.2104***	0.6026	***3.5379***	***2.8194***	1.7445	1.9543	0.0000	1.4493
	Interest rate	***2.2111***	1.1419	1.3683	***2.3084***	0.9442	0.1338	0.1689	1.0503	0.0000

Figure 14: Table of F-statistics for Granger causality tests. All variables are in difference. Null hypothesis that Y does not Granger cause X is rejected when the F-statistic is greater than the critical value of 2.0480.

A.3 Appendix 3: Data description

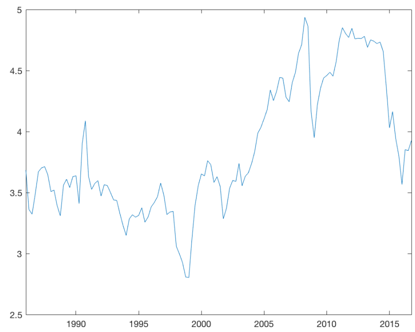
The data is retrieved from Bjørnland, Hilde C., Roberto Casarin, Marco Lorusso and Francesco Ravazzolo (2017) "Oil and Fiscal Policy: Panel Regime-Switching Country Analysis", mimeo., Statistics Norway and Fred Economic data.

We use quarterly data. Most real variables are available from the data sets above except real government expenditure, real tax revenue and real oil price. We construct there series from nominal series by deflating with the CPI. We have taken the log of all endogenous variables except for the non-oil deficit and interest rate. OECD and the oil price is log detrended. All variables are seasonally adjusted. We seasonally adjusted the FNI series and tax revenue in R. The R-package provides a wrapper around the X-13 ARIMA-SEATS Fortran libraries provided by the US Census Bureau. For the specifications containing FNI, we run the SVAR in the sample from 1988Q4 to 2014Q4. For all other specifications, the sample is from 1986Q1 to 2016Q4.

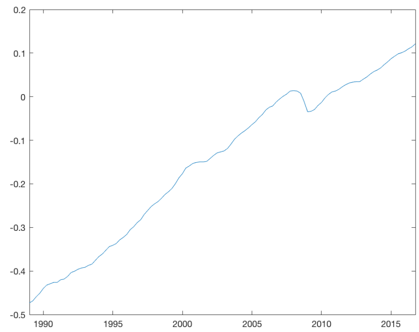
Description of the variables

DEF - Change in the structural non-oil deficit as percentage of trend GDP for mainland Norway. The series is constructed from yearly data under the assumption that the relative value of the deficit in a quarter to the year value, are the same as relative the value of real government expenditure in that quarter to a year.
FNI - The government financial new index (FNI), produced to us by Retriever/CAMP_BI. The FNI is designed to track Norwegian GDP growth and the business cycle at high frequency. Its underlying indicators are daily time series representing how much the media writes about various topics. Read more on: https:www.retriever.no_/fni
G - Real government expenditure, constructed from total government expenditure deflated with Norwegian CPI
GDP - Norwegian mainland GDP, marked value, constant 2015-prices
I - Money market rate (NIBOR)
OECD - OECD GDP by expenditure in Constant Prices: Total GDP for the OECD Total Area, Index 2010=1
Oilrev - Government oil revenue
Poil - Oil price
PE - Public employment
Tax - Tax revenue

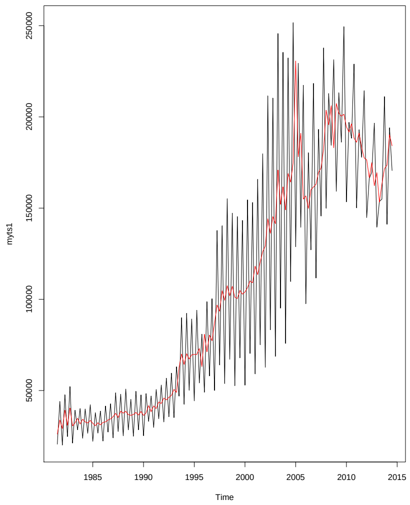
Below are plots of oil price, OECD production and tax revenue. The remaining variables are plotted in figure 2.



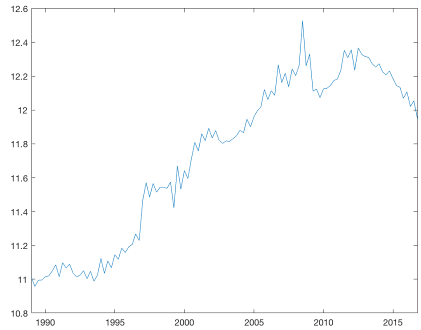
Log of oil price



Log of OECD production



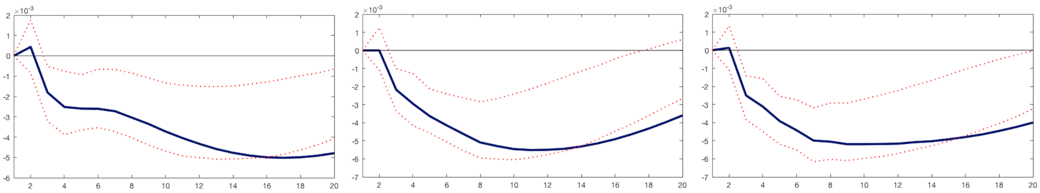
Original and seasonally adjusted of tax revenue



Log of seasonally adjusted tax revenue

Figure 15: Data plots of oil price, OECD production and tax revenue

A.4 Appendix 4: Impulse responses of GDP to monetary policy shocks in our SVAR model



Specification with deficit | Specification with public employment | Specification with government expenditure

Figure 16: Impulse responses of GDP to monetary policy shock generated from the three SVAR specifications, including OECD production as an exogenous variable as described in equation 7. Shocks are normalized to unit shocks, i.e. 1%. The areas between two red dotted lines represent 68% confidence bands calculated using a bootstrap with 2000 draws.

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