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# IMF Working Paper

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Counting the Oil Money and the Elderly:  
Norway's Public Sector Balance Sheet

by Ezequiel Cabezon and Christian Henn

***IMF Working Papers* describe research in progress by the author(s) and are published to elicit comments and to encourage debate.** The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

I N T E R N A T I O N A L M O N E T A R Y F U N D

**IMF Working Paper**

European Department

**Counting the Oil Money and the Elderly: Norway's Public Sector Balance Sheet**

**Prepared by Ezequiel Cabezon and Christian Henn<sup>1</sup>**

Authorized for distribution by Jacques Miniane

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**Abstract**

Based on a permanent income analysis, Gagnon (2018) has prominently suggested that Norway has saved too much, thereby free-riding on the rest of the world for demand. Our public sector balance sheet analysis comes to the opposite conclusion, chiefly because it also accounts for future aging costs. Unsurprisingly, we find that Norway's current assets exceed its liabilities by some 340 percent of mainland GDP. But its nonoil fiscal deficits have grown very large (to almost 8 percent of mainland GDP) and aging pressures are only commencing. Therefore, Norway's intertemporal financial net worth (IFNW) is negative, at about -240 percent of mainland GDP. As IFNW represents an intertemporal budget constraint, this implies that Norway's savings are likely insufficient to address aging costs without additional fiscal action.

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## I. A COMPREHENSIVE VIEW OF PUBLIC FINANCES

1. **Most of the literature on Norway’s resource wealth highlights the sound management of proceeds.** Gylfason (2001) and Larsen (2006), for instance, emphasize the key role of Norway’s strong fiscal institutions. These have ensured that much of the oil revenues since the mid-1990s has been saved in a sovereign wealth fund and invested abroad. The fiscal rule then allows only the real expected return of the fund, but not any part of the fund’s principal balance, to be spent. This has facilitated gradual phasing in of oil revenues into the economy and to a large extent insulates fiscal spending from commodity prices.<sup>2</sup>

2. **But controversy has been sparked by Gagnon (2018), who argues that Norway has saved too much.** Gagnon, based on his permanent income analysis, argues that Norway has been free-riding on the rest of the world for demand, because it has not been spending enough of its wealth in the present (and recent past). Thereby, he concludes, future generations have been excessively benefiting at the expense of the present one. However, he does not take into account that aging costs for the present generation will still accrue in the future to the public sector—which in Norway funds virtually all pensions and health and long-term care. Apart from these aging trends, which are part of the future fiscal path, his analysis also does not account for any pre-existing public assets and liabilities unrelated to oil and gas.

3. **Public sector balance sheet analysis can provide a proper intertemporal benchmark of whether a country is saving too much or too little.** It aggregates into a single measure the present value of all public assets and liabilities and the future fiscal path to judge long-term fiscal sustainability. In the context of other countries, such broader concepts of government *net worth* have been found to be superior to simple debt sustainability analyses. The information they supply is more relevant for decisions. For instance, an increase in public investment would increase debt, *ceteris paribus*. But it could positively affect net worth, because it would also add to the public asset stock and may strengthen future public revenues. A balance sheet approach allows to account comprehensively for these offsetting factors. In addition, net worth measures from public balance sheets have been shown to outperform debt measures in predicting long-term sovereign spreads both in advanced and emerging economies (Gruber and Kamin, 2012; Hadzi-Vaskov and Ricci, 2017). The balance sheet approach holds several more advantages (§5,6) and is particularly important for a country like Norway with substantial public sector assets.

4. **Public sector balance sheet analysis proceeds in two steps.** Deriving a static balance sheet represents the first step (Section II). This requires intense data work, which we describe more in Annex I. In a second step, the static balance sheet is augmented with future fiscal flows into an intertemporal balance sheet (Section III.A), which can then be subjected to stress tests to determine the size of a prudent fiscal buffer (Section III.B). This prudent

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<sup>2</sup> Section II. A provides more details on Norway’s fiscal institutions to administer resource revenues.

fiscal buffer than serves as an anchor in the analysis of different (policy) scenarios to help determine which ones are intertemporally sustainable and which would require adjustment over time (Sections III.C and D). Higher fiscal spending out of oil revenues does carry a higher risk of reducing competitiveness, including via higher domestic wages, which also needs to be weighed in designing fiscal policy.

5. **The static fiscal balance sheet includes the following in addition to gross debt.** Annex I provides details on the data and compilation.

- **Assets.** Accounting for assets is particularly important for a country like Norway, given that it holds considerable public assets in three forms. First, like any other country, the public sector owns buildings, infrastructure, and land. Second, despite already having extracted offshore oil and gas since the 1970s, considerable reserves remain, whose extraction over the next decades will add to public revenues. Third, Norway’s sovereign wealth fund—named Government Pension Fund Global (GPFGL)—through which these oil revenues are administered has grown large; its assets made up just over 300 percent of mainland Norway’s GDP at end-2017. While these sizable assets allow Norway’s fiscal spending to be higher than that of an otherwise comparable country, their value also fluctuates considerably in response to oil and gas prices and global asset prices. Including assets in the analysis also allows to properly account for public investment decisions.<sup>3</sup>
- **Public Corporations.** Including the accounts of financial and non-financial public corporations provides a more comprehensive view of fiscal sustainability.<sup>4</sup> It is important in Norway, given these firms’ considerable role in the economy. Public corporations are defined as those enterprises over which the state directly exerts control.<sup>5</sup> They can be an important source of revenue to the public sector. However, they might also comprise risks that would not be accounted for in general government statistics, in the form of quasi-fiscal deficits or other (explicit or implicit) support mechanisms.

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<sup>3</sup> While this is not very pertinent in the case of Norway, it is also important to mention that accounting for assets allows one to distinguish between structural and non-structural debt reduction measures. Non-structural measures reduce debt via decumulation of assets (e.g., privatization, running down assets). Structural measures in contrast increase net worth, either by decreasing debt stocks or via accumulation of assets. Thus, incorporating assets could discourage ‘creative accounting’ (e.g., Milesi-Feretti, 2004).

<sup>4</sup> It would also eliminate the possibility of governments shifting deficits or debt to public corporations not subject to standard debt sustainability analyses.

<sup>5</sup> Note that public sector equity holdings in companies in which the state does not exert control do not comprise public corporations. Such equity holdings are instead only recorded as financial assets of the general government.

- **Existing pensions liabilities.** Another aspect that is largely ignored in standard government statistics is obligations related to pensions. “Existing” here means that they relate to work that has already been performed in the past. In Norway, the government receives social security contributions from all workers, whether employed in the public or private sector. In return, the government pays out pension benefits when workers reach retirement. The pension system in Norway is funded by the government and is pay-as-you-go.<sup>6</sup>

6. **The intertemporal public sector balance sheet adds net present values of all future fiscal balances.** Therefore, some authors also refer to it as the comprehensive balance sheet. Including revenues is important as the power to tax is generally any country’s largest asset, and this is also the case for Norway. Future expenditures also need to be included, and need to appropriately reflect future aging pressures.<sup>7</sup> While the intertemporal balance sheet provides the most comprehensive view of public finances, it obviously involves many assumptions in constructing the future fiscal path. It is therefore subject to considerable uncertainty, unlike the static balance sheet. It, however, lends itself to scenario analysis of different future fiscal paths and therefore the quantification of policies’ impact on fiscal sustainability.

7. **Not surprisingly, our analysis shows that Norway’s static fiscal position is highly positive.** Static public sector net worth for Norway stood around 340 percent of mainland GDP as of 2017, driven mainly by GPFG assets and the present value of remaining oil and gas deposits.

8. **But, more surprisingly, Norway’s intertemporal financial net worth (IFNW) is negative.** Non-oil fiscal deficits have been rising steadily over the past 15 years. While they were less than 2 percent of mainland GDP in the early 2000s, they now stand close to 8 percent of mainland GDP. The rise occurred during a period of positive aging trends—but aging costs will now start to mount. Therefore, in a passive baseline scenario wherein deficits increase one-to-one in line with aging costs, Norway’s IFNW would be negative at close to -240 percent of mainland GDP. These results contradict Gagnon (2018). If aging is accounted

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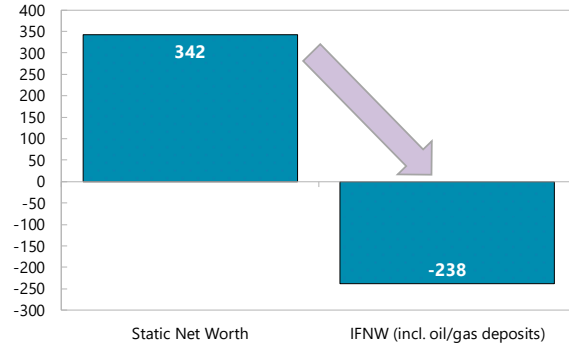
<sup>6</sup> Note that in many other countries, the government has an explicit obligation only for public employee pensions.

<sup>7</sup> Future payment streams on already existing pension liabilities (which are included in the static balance sheet) need to be excluded from expenditures to avoid double counting. However, expenditures need to include payments for future pension liabilities.

for, present nonoil fiscal deficits in Norway are actually high relative to static savings.<sup>8</sup> IFNW expresses this in a single number.

9. **Fiscal action to address aging pressures will ultimately be necessary, given that IFNW represents an intertemporal budget constraint.** While positive surprises are a distinct possibility—Norway’s net worth is very sensitive to financial market valuations, and assumptions about oil prices and oil production—it would seem prudent to start identifying possible fiscal savings, ideally without compromising quality of public services. Continued adherence to the fiscal rule would ensure long-run fiscal sustainability and achieve a positive IFNW of slightly over 60 percent of mainland GDP—a value that our stress test suggests would provide a sufficient buffer to absorb a large shock. This is because sticking to the rule will require significant fiscal adjustment from the 2030s onwards, even in excess of increases in aging costs in many years, to compensate for absence of adjustment until then. A hypothetical frontloaded adjustment of 5 percent of mainland GDP would achieve the same boost to IFNW and preempt any future consolidation needs in response to aging. However, Norway’s highly positive static net worth provides leeway for smoothing the needed adjustment.<sup>9</sup>

**Static and Intertemporal Financial Net Worth (IFNW), 2017**  
(Percent of mainland GDP)



Sources: Norwegian Authorities and IMF Staff calculations and estimations.

10. **Forthcoming public sector balance sheet analyses of other countries should be helpful to put Norway’s situation in international perspective, but some comparison is already possible.** The recent paper by Brede and Henn (2018) constructs a public sector balance sheet for Finland. Interestingly, despite having a comparable social model, Finland’s balance sheet is the reverse of Norway’s. Finland has negative static net worth, but—given low fiscal deficits and with a part of adverse aging effects already absorbed—slightly positive intertemporal net worth. Benchmarking of Norway’s fiscal expenditures to Finland and other peers can suggest some areas of savings potential (Section III.A). Expansion of fiscal balance sheet analysis to a series of countries in the October 2018 IMF Fiscal Monitor (IMF, 2018) will allow for a broader comparison of Norway.<sup>10</sup>

<sup>8</sup> While Gagnon (2018) does not take aging into account, he, however, highlights the important point that the present value of oil and gas deposits in the ground—which has no bearing on Norway’s fiscal rule—should be considered in charting a long-term fiscal stance. Our balance sheet analysis explicitly accounts for this also.

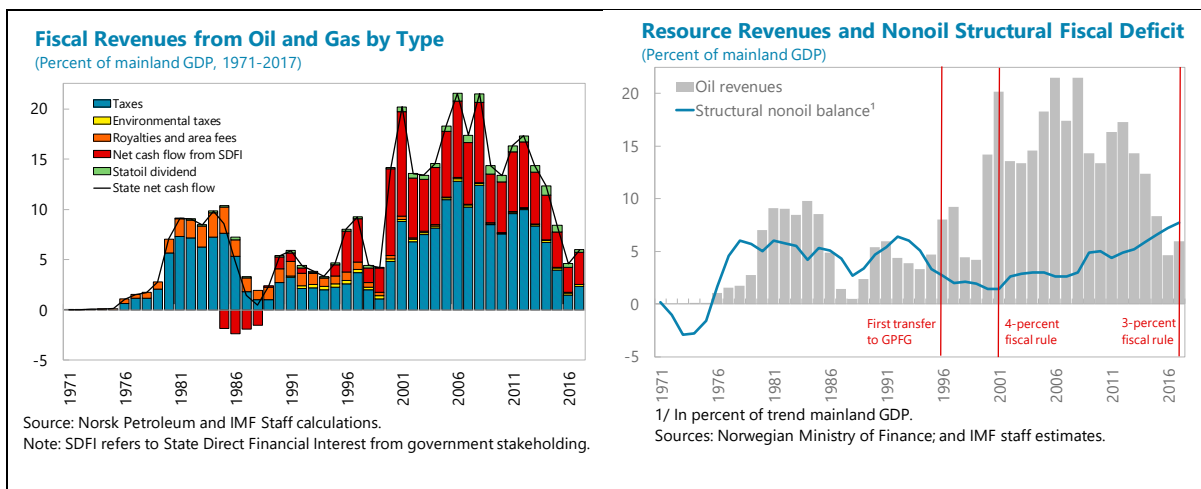
<sup>9</sup> In addition to pensions, health care in Norway is also funded by the government.

<sup>10</sup> Governments do not yet routinely construct public sector balance sheets, although there are some exceptions (Australia, New Zealand). There is also some earlier Fund work on fiscal balance sheets for several countries; see IMF (2006 a, b; 2008; 2009).

## II. NORWAY'S STATIC PUBLIC SECTOR BALANCE SHEET (PSBS)

### A. Management of Oil Revenues and Fiscal Policy in Norway: A Primer

11. **Resource receipts from oil and gas have had a major bearing on Norwegian public wealth since the late 1990s.** Norway discovered oil in the late 1960s. The discovery was followed by a long phase of large investments in the industry. During the late 1980s and most of the 1990s, low oil prices subdued the government's resource rents from oil and gas, despite the 78 percent tax rate on oil companies to ensure that most rents flow to the government. Nonetheless, Norway decided in 1990 to establish the GPFG to administer oil revenues and the first net transfer to the GPFG occurred in 1996 (Figure 1). The GPFG helps smooth fluctuations in fiscal policy and has helped contain fiscal deficits when compared to the very large oil revenues during 2004–13. By undertaking its investments abroad, the GPFG also limits Dutch Disease concerns. Managed by an operationally separate unit inside Norges Bank, it is largely sheltered from political influence; this would remain so no matter the outcome of ongoing discussions to reform its institutional structure.<sup>11</sup>

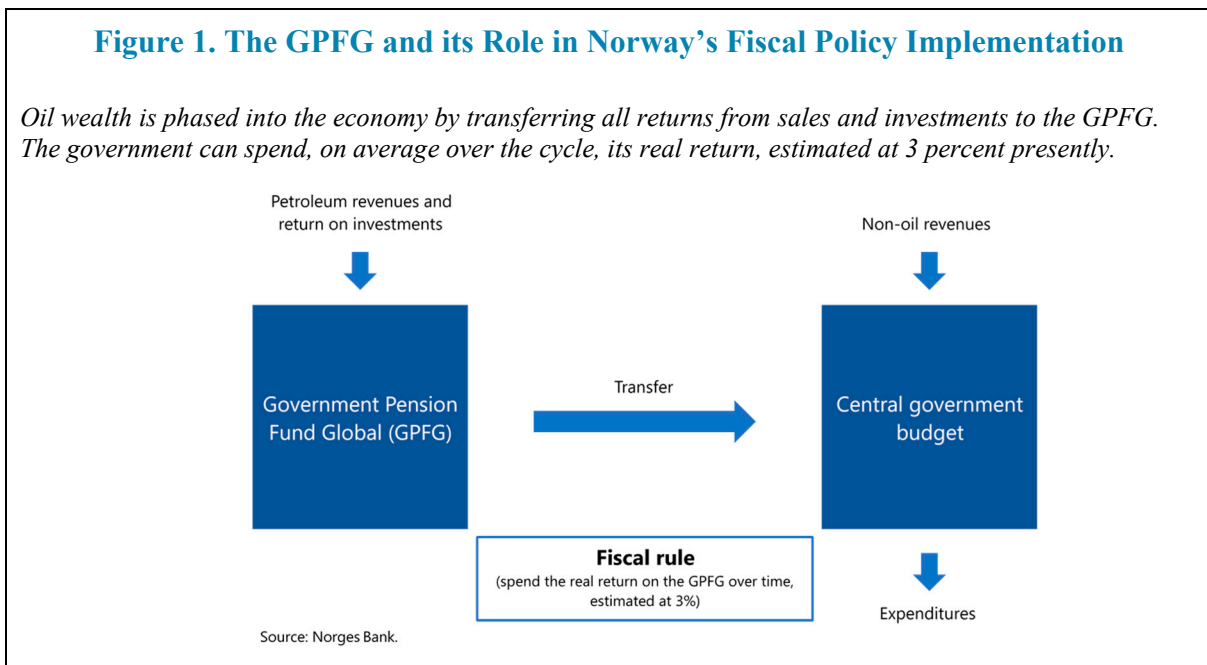


12. **The GPFG helps smooth the flow of oil revenues into the Norwegian economy.** To ensure that some of the benefits of oil revenues are preserved for future generations, Norway in addition introduced a fiscal rule in 2001. It determines that—on average over the cycle—only the expected real return of the GPFG can be spent to finance the non-oil fiscal deficit. This expected real return was set at 4 percent until early 2017, at which time it was revised to 3 percent, *inter alia* in light of the low interest rate environment (Norges Bank, 2016; Norwegian Government, 2016, 2017). Given the fiscal rule, the asset stock is expected to remain intact in real Norwegian krone terms and grow

<sup>11</sup> Separating the GPFG into a statutory entity outside the central bank is being considered mainly because the large size of the fund is placing greater demands on the Norges Banks' board and senior management.



every year in line with oil revenues. However, as oil and gas production decreases, the Fund's value would eventually start to decline relative to mainland GDP.



13. **The GPFG has grown considerably over time and at end-2017 had reached three times the size of mainland Norway's GDP** (Figure 2). Up to 2012, the main contributor to growth in the GPFG remained revenues from oil sales, partly in light of high oil prices. The investment returns have become more important over time, given the fund's size. During the 2014–17 period, the GPFG's investment returns outstripped its oil revenue inflows by a factor of 2.6, as global asset market valuations recorded strong increases while oil prices had declined to the \$40–60 range. Over the past two decades, the GPFG's annual real yield on a Norwegian krone basis was 5.8 percent on average.

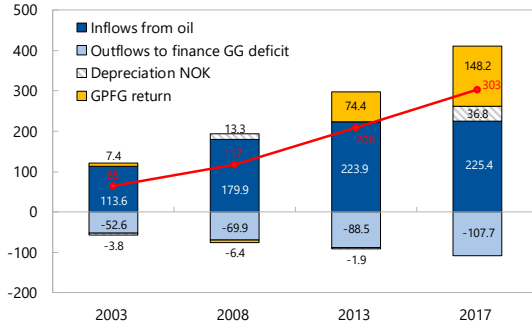
14. **Non-oil fiscal deficits have been increasing considerably over the past decade.** The 2017 structural non-oil deficit has come close to 8 percent of mainland GDP. Since the late 1990s, the deficit has expanded by more than 6 percentage points of mainland GDP. Deficit increases were stronger during economic slowdowns when countercyclical policies were deployed, such as most recently in response to the 2014 oil downturn. However, during good economic times, deficits tended to rise as well, although more gradually. As the fiscal rule is tied to the GPFG and given the strong increases in the GPFG's asset stock, the higher deficits of recent years remain in line with the fiscal rule, despite the recent tightening of the spending limit to 3 percent of the fund's balance. During 2016 and 2017, the withdrawals from the GPFG to finance the government non-oil deficit were for the first time higher than inflows to the fund from petroleum sales.

## Figure 2. Developments in the GPFG and the Non-Oil Fiscal Policy Balance Fiscal Policy Implementation

The GPFG has grown large and its returns are now larger than receipts from oil sales.

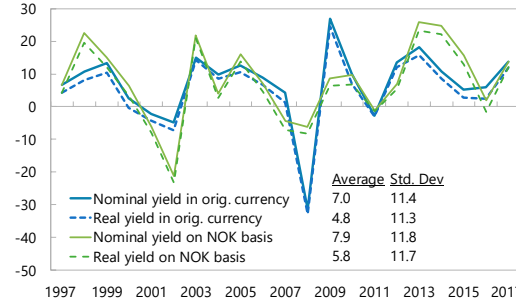
Over the past two decades, GPFG returns have been high due to positive financial market trends.

**GPFG Stock and Accumulated Flows**  
(Percent of Mainland GDP)



Sources: IMF World Economic Outlook and Norwegian Petroleum Directorate.

**GPFG yields**  
(Percent)

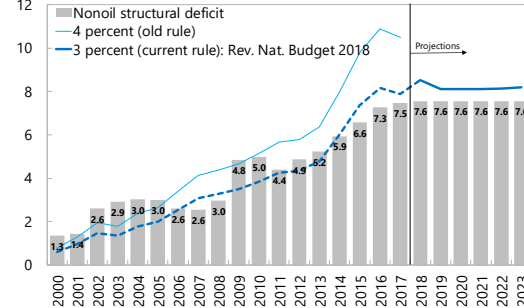


Sources: Norges Bank Investment Management and Fund Staff calculations.  
Note: Average and standard deviation of yields is based on the 1997-2017 period.

With the growth of the GPFG, the fiscal rule has become looser, despite the revision down to 3 percent.

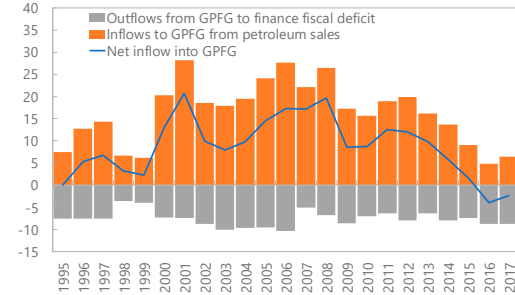
In 2016 and 2017, GPFG outflows to finance the deficit have outstripped oil revenues.

**Central Government: Structural Balance**  
(Percentage of mainland trend GDP<sup>1</sup>)



<sup>1/</sup> Estimate of mainland trend GDP is taken from the Norwegian Ministry of Finance.  
Sources: Norwegian Ministry of Finance and Fund Staff estimates.

**GPFG: Inflows and Outflows**  
(Percent of mainland GDP)

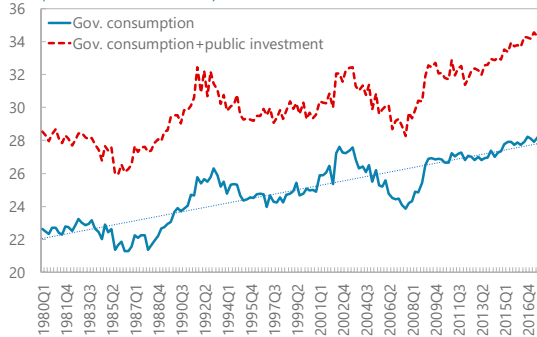


Sources: Norges Bank; and IMF staff calculations.

The GPFG funded an expensive fiscal policy in the last decade...

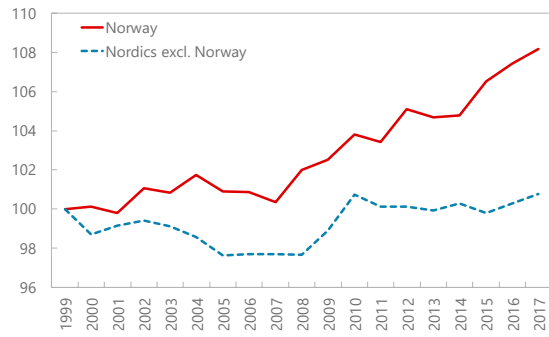
... during which public sector wages also expanded faster than in peer countries.

**Government Footprint on the Economy**  
(Percent of mainland GDP)



Sources: Statistics Norway; and IMF staff estimates.

**Public-to-Private Sector Wages**  
(1999=100)



Sources: Country authorities; and IMF staff estimates.

15. **These deficits could rise further—subject to performance of the GPFG.** For the next years, the Norwegian authorities project that the 3 percent rule would imply that deficits could remain broadly constant as a percentage of mainland GDP. However, past forecasts have consistently underpredicted the future GPFG asset stock, partly due to better-than-expected global asset price developments. If this pattern were to continue and spending were to evolve in line with the fiscal rule, deficits could rise further.

## B. Structure of Norway’s Static PSBS in 2017

16. **Norway’s static public sector net worth is highly positive.** As of end-2017, it is estimated at 342 percent of mainland GDP.<sup>12</sup> Norway’s largest assets are those of the GPFG and the remaining oil and gas deposits. However, in addition, both the general government and public corporations hold substantial additional financial assets. “Existing” pensions, i.e. those relating to work performed until 2017, constitute the largest liability at 252 percent of mainland GDP. This section provides detail on the individual components of Norway’s static public sector balance sheet; Annex I elaborates further on the underlying data and methodology.

17. **The value of the general government’s nonfinancial assets is 237 percent of mainland GDP.** Of those, the present value of remaining oil and gas deposits make up the lion’s share, estimated at 149 percent of mainland GDP. We calculated this present value based on the Norwegian Ministry of Finance’s projections for future revenues from petroleum sales consistent with a long-term oil price of around US\$60 per barrel,<sup>13</sup> and a nominal discount rate of 5 percent.<sup>14</sup> The calculation is naturally subject to uncertainty, including with respect to projections of production volumes over the long term. Over the last two decades, forecast revisions have usually resulted in increases in projected production. General government nonfinancial assets other than oil and gas stand at close to 90 percent of mainland GDP. As in other countries, they are mainly made up of buildings (including schools, hospitals, and government agencies) and other physical infrastructure (including road, rail, electricity, and sewage networks).

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<sup>12</sup> This figure is based mostly on actual data. The main estimates included are the value of existing pension liabilities, and the present value of oil and gas deposits, which depends on the profile of future production, future oil prices, and a discount rate of 5 percent. Value of some smaller components, e.g. land holdings (within nonfinancial assets), also had to be estimated when 2017 data were not yet available. Annex I elaborates.

<sup>13</sup> See Annex I and Section III.C for further details and an analysis of the impact of different oil price assumptions.

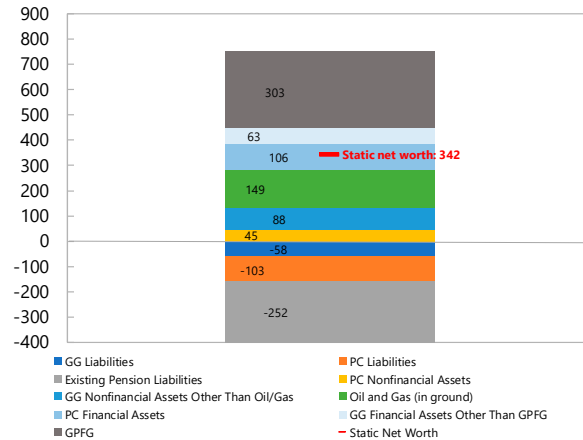
<sup>14</sup> See Annex I for further background on the discount rate.

### Figure 3. Norway's Static Public Sector Net Worth

Norway's static net worth is high, mainly driven by the GPFG and remaining petroleum deposits. Existing pensions—i.e. those relating to work already performed—are by far the largest liability.

#### Static Public Sector Net Worth by Components

(Percent of mainland GDP, 2017)



Sources: Norwegian authorities and IMF Staff calculations and estimations  
Note: GG = General government; PC = Public corporations.

#### Norway: Static Public Sector Balance Sheet (In Percent of mainland GDP)

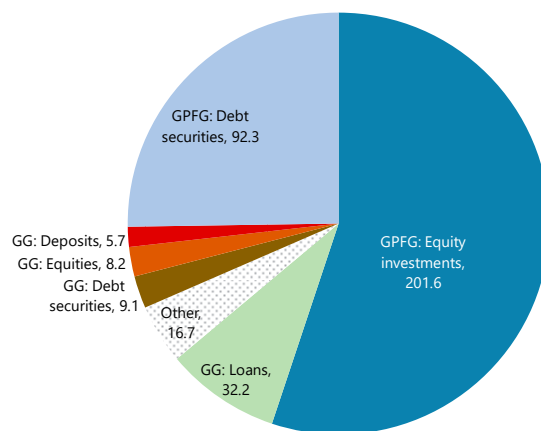
	2017
<b>A (=B+D-F) Static Net Worth</b>	<b>341.7</b>
<b>B General Government</b>	<b>545.4</b>
Assets	603.0
Nonfinancial	237.1
Oil and gas (in ground)	149.1
Other	88.1
Financial	365.8
GPFG	302.7
Other 1/ 2/	63.1
Liabilities 3/	57.5
<b>D Public Corporations and Central Bank</b>	<b>47.8</b>
Assets	150.7
Nonfinancial	44.9
Financial 3/	105.8
Liabilities 2/	102.9
<b>F Existing Pension Liabilities</b>	<b>251.5</b>
<b>Memorandum item:</b>	
Nominal mainland GDP (NOK billions)	2,803.8

Source: Authors' calculations and estimations based on various data sources (see Annex I).  
1/ 2/ 3/ These items include adjustments for consolidation. See notes of Table IV.1 for details.

18. **General government financial assets amount to 366 percent of mainland GDP, with equity investments making up more than half.** Of these assets, the lion's share is managed under the GPFG (303 percent of mainland GDP). As of end-2017, the GPFG's asset stock consisted to 66.6 percent of equities, 30.8 percent of fixed-income investments, and 2.6 percent of unlisted real estate investments.<sup>15</sup> This results in a large exposure of the PSBS to fluctuations in equity prices. There are also some smaller equity holdings outside of the

#### General Government Financial Assets, 2017

(Percent of mainland GDP)



Sources: Statistics Norway, Eurostat, and Fund Staff estimates.  
Notes: The category "Other" includes mainly accounts receivable. Equities exclude shares in public corporations and the equity of the central bank. Deposits exclude those at the central bank.

<sup>15</sup> See [Norges Bank Investment Management](#). To keep the exposition simple, we keep the unlisted real estate investments together with the GPFG financial investments, although the former would more appropriately be classified as nonfinancial assets.

GPF (8 percent of mainland GDP).<sup>16</sup> These comprise to broadly equal shares (i) holdings of the smaller Government Pension Fund Norway, a traditional pension fund established in 1967 to manage, under the Ministry of Finance's direction, any surpluses in the National Insurance Scheme by investing in the Nordic region;<sup>17</sup> and (ii) minority shareholdings of the general government. The latter are mainly comprised of a 1/3 participation in each of DNB (Norway's largest bank), Yara International (Agricultural Chemicals), and Norsk Hydro (Aluminum and renewable energy).<sup>18</sup> Other financial assets held outside the GPF consist of loans and debt securities (41 percent of mainland GDP) and deposits and accounts receivable (18 percent of mainland GDP).

**19. Public corporations' contribution to static net worth is almost 50 percent of mainland GDP.** Public corporations are those companies over which the governments can exert direct control, generally through a majority equity stake. Equity of nonfinancial public corporations' including the central bank amounts to about 48 percent of mainland GDP.<sup>19</sup> The government does not hold any controlling stakes of mention in other financial corporations.<sup>20</sup> Assets of nonfinancial public corporations including the central bank amounted to 151 percent of mainland GDP, juxtaposed against 103 percent of mainland GDP in liabilities. More than two thirds of public corporations' assets are financial in nature. However, this share could be lower if the data could be further consolidated (i) among public corporations and (ii) with general government entities. Absence of consolidation inflates both the asset and liability stocks, but fortunately leaves net worth measures—our primary interest—unchanged. The largest public corporations are the petroleum company Equinor, formerly known as Statoil; the telecommunications company Telenor; and the power company Statkraft (Norwegian Ministry of Trade, Industry and Fisheries, various years).<sup>21</sup>

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<sup>16</sup> This is a figure resulting after consolidation of general government equity investments with the public corporations sector; non-consolidated values for general government equity investments outside the GPF are much larger. See Annex I and the footnotes of tables in Annex IV for further details on the consolidation.

<sup>17</sup> See [www.folketrygdfondet.no](http://www.folketrygdfondet.no) for more information.

<sup>18</sup> See Norway's [State Ownership Reports](#) for more information.

<sup>19</sup> Thereof, 8½ percent of mainland GDP are accounted for by the central bank.

<sup>20</sup> An exception is Kommunalbanken, which is 100 percent publicly owned; its book equity value at end 2016 amounted to NOK 12.4 billion (0.5 percent of mainland GDP). The government does hold a 34 percent stake in DNB, the largest domestic bank, but does not exert control over operations (see Norwegian Ministry of Trade, Industry and Fisheries, 2014). As a result, this participation is included in financial assets, not under public corporations.

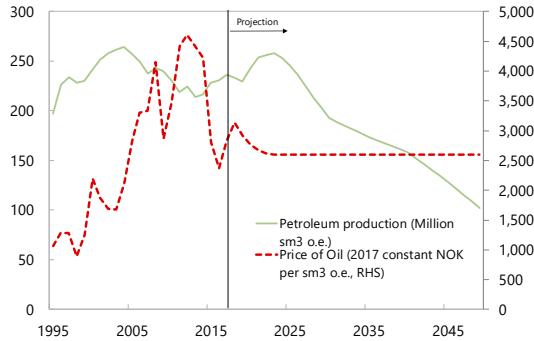
<sup>21</sup> At end 2016, total value of equity stood at 18.9 percent of mainland GDP for Equinor. The comparable figures for Telenor and Statkraft were 7.1 and 2.7 of mainland GDP, respectively. To avoid double counting the value of remaining oil and gas deposits, we have carefully examined Equinor's balance sheets and confirmed that it is not included therein (see Annex I).

**Figure 4. Norway's Nonfinancial Assets**

*Oil revenues are projected to decline after the mid-2020s. But projections involve uncertainty ...*

*... related to oil prices and production volumes. For example, the latter depend on future discoveries.*

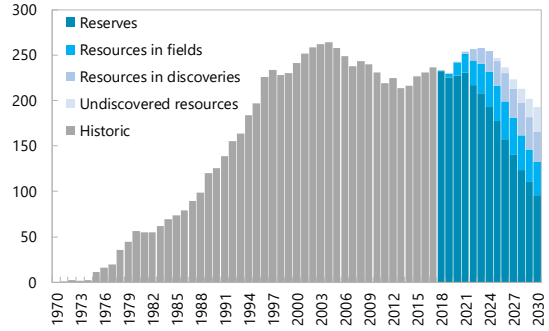
**Projections of Petroleum Production**



Sources: Norsk Petroleum and Norwegian Government (2015).

**Petroleum Production**

(Millions of cubic meters of oil equivalent per year)



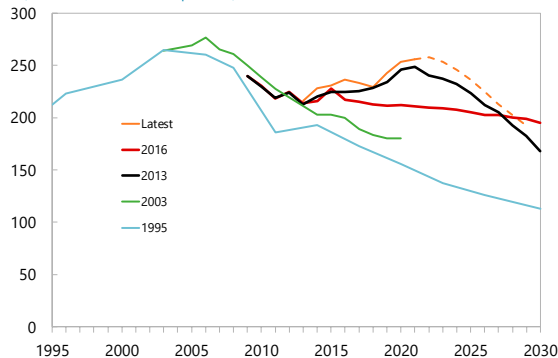
Source: Norwegian Petroleum Directorate Report "The Shelf in 2017".

*Production has stayed higher for longer than expected by the authorities' past forecasts, not least because of advances in the technologies used in oil extraction.*

*Other nonfinancial assets are mainly made up of buildings and other physical infrastructure.*

**Projected Petroleum Production in Selected Projection Years**

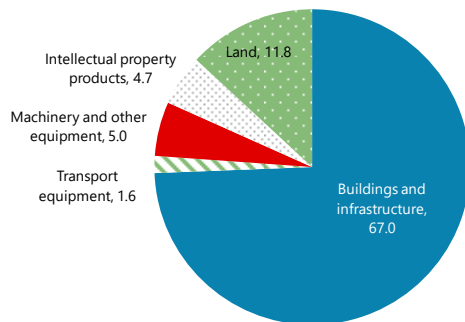
(Million cubic meter oil equivalent)



Sources: Norsk Petroleum Resource Reports.

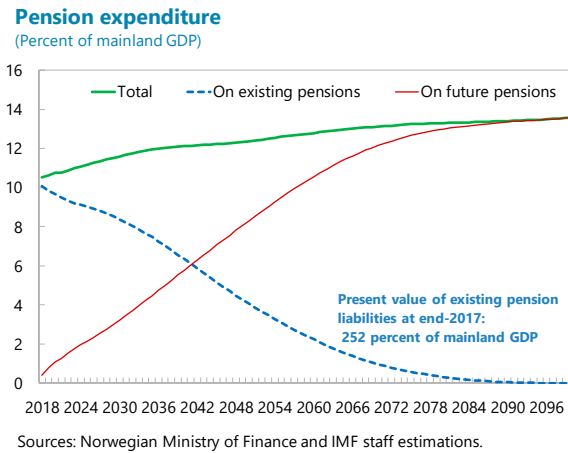
**Nonfinancial Assets other than Oil and Gas, 2017**

(Percent of mainland GDP)



Sources: Statistics Norway, Eurostat, and IMF Staff estimates.

20. **Pensions accrued to date are the largest liability in Norway’s static balance sheet.** The present value of such “existing” pension liabilities, relating to work performed until end 2017, are estimated at 252 percent of mainland GDP. Obtaining this figure requires splitting the future stream of total pension expenditures into those relating to existing pensions and those relating to future work.<sup>22</sup> Other liabilities of the general government are moderate at 58 percent of mainland GDP. Thereof, debt securities, loans, and accounts payable, and debt securities constitute 24, 25, and 9 percent of mainland GDP, respectively. Debt securities are issued mainly to provide a NOK-denominated safe asset to establish a yield curve and facilitate the conduct of monetary policy and operation of the financial markets.



### C. Evolution of Norway’s Static Net Worth and Risks and Hedges in Norway’s Static PSBS

21. **Volatility in Norway’s static net worth can be large and has implications for policymakers.** Volatility results mainly from fluctuations in oil and gas prices and in asset prices (Figure 5). For policymakers, this implies that they should not react to fluctuations in any single year. Rather, they would be well advised to put in place any needed reforms that allow them to react to many possible scenarios, including to address any longer-term shortfalls that may emerge. Tightening policies tends to be more politically difficult than loosening. Therefore, forward-looking gradual introduction of reforms would be advisable if the PSBS suggests that ultimately savings would be needed. If reforms are introduced sufficiently early, just maintaining spending increases below nominal GDP growth for some time may be sufficient. If positive surprises did happen to materialize, policies could be loosened gradually to avoid excessive saving.

22. **In discussing the evolution of Norway’s static net worth, we distinguish between three different periods of low, high, and moderate oil prices.** This is intuitive, given the large influence of oil prices on Norway’s static net worth. The first period of low oil prices ranges from the start of our sample in 1995 to 2003. The second period of high oil prices

<sup>22</sup> See Annex I for more details, including on our 5 percent nominal discount rate. We thank Dennis Fredriksen and Nils Martin Stølen at Statistics Norway for kindly computing this breakdown for us.

ranges from 2004–13, before oil prices moderated to a range of 40–60 U.S. dollars per barrel during 2014–17.

23. **During 1995–2003, Norway’s static net worth fluctuated around 100–110 percent of mainland GDP.** Oil and gas production was quite high and rising throughout this period, despite low petroleum prices. This wealth was converted into assets held by the GPF, which grew to 65 percent of mainland GDP by the end of the period. With returns on the fund being low during this period, the GPF’s growth was driven mainly by the oil inflows. Despite significant extraction during the period, the present value of oil and gas deposits remaining in the ground was slightly higher (by 9 percent) in 2003 than in 1995 *in NOK terms* for two reasons. First, spot oil prices increased from US\$17 to US\$28 per barrel between 1995 and 2003 and second, production forecasts were upwardly revised. However, nominal mainland GDP increased by 58 percent over the same period, so that the value of remaining oil and gas deposits decreased considerably relative to mainland GDP.

24. **During the 2003–13 period of high oil prices, Norway’s static net worth rose to 480 percent of mainland GDP.** With oil production remaining high, the GPF grew by 85 percent of mainland GDP on account of new inflows. Asset price rises over the length of the period contributed to increase the GPF by another 58 percent of mainland GDP, despite the declines during the global financial crisis. Other items contributed 36 percent of mainland GDP to higher static net worth, mainly driven by asset accumulation of public corporations, while their liabilities remained constant. However, the largest contribution to higher net worth resulted from a revaluation in the present value of remaining petroleum reserves by some 200 percent of mainland GDP, as futures prices in 2013 indicated that oil prices would remain high.

25. **During 2014–17, lower oil prices decreased static net worth, but high GPF asset returns cushioned the fall.** The post-2014 oil price decline completely reversed the positive revaluation of reserves during the previous period, depressing net worth by close to 240 percent of mainland GDP. However, a continuation of the global asset price boom during the period increased the GPF’s worth by 95 percent of mainland GDP, even as net inflows into the fund halted in light of expanding fiscal deficits to respond to the downturn of the domestic oil industry.

26. **Annual changes in the GPF’s value have been quite stable over time, partly due to natural hedges.** Even during 2008 and 2009, the GPF grew by more than 10 percent each year. This resulted partly as oil revenue inflows remained high during those years. However, a natural hedge in Norway’s PSBS also played a role: the Norwegian krone tends to depreciate when oil prices fall; oil price declines are often associated with global economic slowdowns; and slowdowns are in turn associated with falling asset prices. Therefore, falling asset prices that weigh on the GPF tend to be offset by krone depreciation, stabilizing the domestic currency value of the GPF. A second natural hedge is that increases in oil prices would cause two offsetting effects. It would increase the value of



remaining oil and gas deposits, but also likely diminish the value of the GPFG in NOK terms, given that oil price increases are typically associated with NOK appreciation. These hedges, however, are likely to become less important as oil reserves become smaller, leaving Norway more exposed to asset price fluctuations.

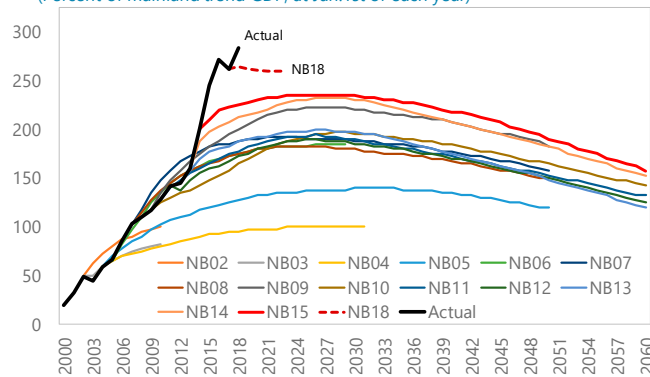
**27. Higher global asset valuations would now be both a blessing and a challenge.**

Since the early 2000s, the GPFG consistently overperformed relative to projections. If it continued to do so, Norway would be richer, on the one hand. But, on the other hand, combined with the GPFG's large size, it would also pose challenges to fiscal policy. The 3-percent fiscal rule would become laxer in nominal terms. Absent a change in the rule or conduct of fiscal policy, this could result in even higher nonoil deficits. That, in turn, could (i) elevate competitiveness concerns given already high wage levels (Cabezon and Henn, 2018); and (ii) make consolidation later more difficult.

**28. A correction in global asset prices constitutes a risk.** Asset valuations are high by many measures, suggesting that a correction or lower returns going forward are possible.

And in contrast to 2008–09, net inflows into the GPFG are now negative because of high nonoil fiscal deficits. This suggests that the GPFG's value would likely decrease considerably in case of an asset price bust. If such a case were to materialize, the 3-percent fiscal rule would also imply that—at least over the longer term—fiscal policy would need to be tightened, which could temporarily weigh on growth.

**Historical Forecasts for the GPFG Asset Stock**  
(Percent of mainland trend GDP, at Jan. 1st of each year)



Note: NB denotes National Budget.

Sources: Norwegian Ministry of Finance and IMF staff estimates.

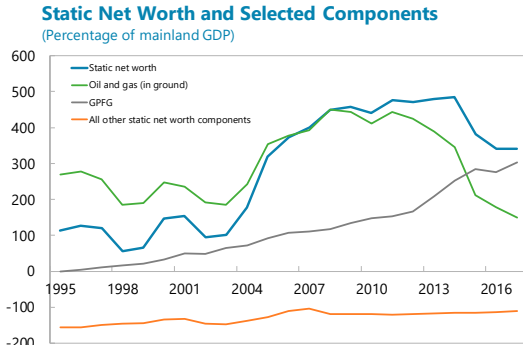
**29. Mismatched risks could result from asynchronous changes in assets and pension liabilities.**

Public pension liabilities in nominal terms increase gradually over time and will do so more rapidly now as Norway is shifting from a favorable to a prolonged adverse aging trend. In contrast, much of Norway's assets are subject to financial market and oil price fluctuations. The importance of fluctuations in financial markets will become increasingly more important relative to those in oil prices as more and more oil reserves are extracted and converted to financial wealth.

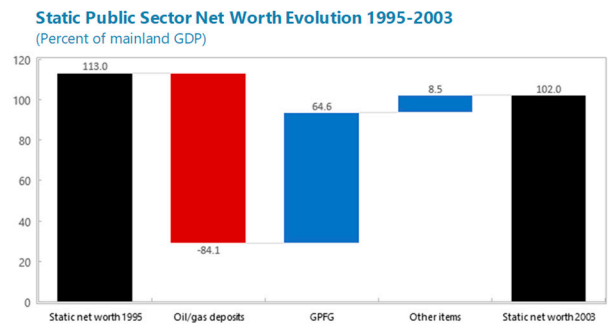
**Figure 5. Historic Fluctuations in Static Net Worth and its Drivers**

*Fluctuations in Norway’s static net worth are mainly driven by value of remaining oil and gas deposits and the GPFG.*

*Norway’s static net worth remained broadly stable during 1995–2003, when oil prices were low.*

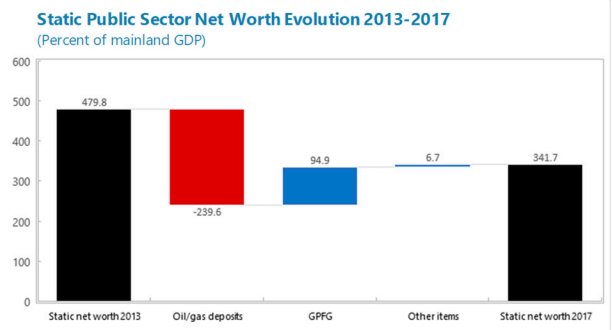
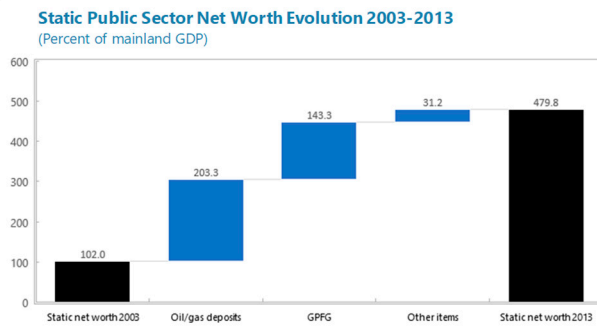


Sources: Norwegian authorities and IMF staff calculations.



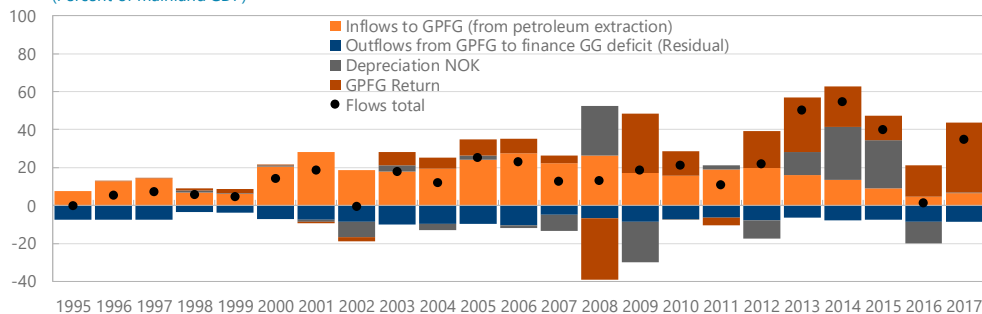
*High oil prices dramatically increased static net worth during 2003–13; higher asset prices provided additional support.*

*During 2013–17, static net worth fell due to low oil prices and cessation of inflows into the GPFG given high fiscal deficits. Positive asset price developments buffered the decline.*



*GPFG returns have been very high in the most recent past. During the global financial crisis, the GPFG’s returns were quite stable as the krone tends to depreciate when oil prices fall; and oil prices tend to decline during global economic downturns.*

**Changes in GPFG Net Worth by Source (Percent of mainland GDP)**



Sources: Norges Bank Investment Management; and Fund Staff calculations.

### III. THE INTERTEMPORAL BALANCE SHEET

30. **The intertemporal balance sheet adds present values of future revenues and expenditures to the static balance sheet.** It thereby recognizes that the largest asset for any government is its power to raise taxes, but also that future expenditures will need to be financed.

31. **The intertemporal balance sheet is subject to considerably more uncertainty than the static balance sheet.** The reason is that assumptions need to be made on a future fiscal path and underlying macroeconomic variables.<sup>23</sup> In addition, the net worth of the intertemporal component of the PSBS is the difference between two large gross figures—the present values of all future revenues and expenditures. As a result, it can be affected considerably by comparably small changes in underlying flows. On the one hand, this shows that moderate but permanent policy changes can have a large impact, but, on the other hand, it is also sensitive to small changes in assumptions.

32. **To devise a long-term fiscal path, WEO projections are extended and supplemented by estimates of aging costs.** The April 2018 IMF World Economic Outlook (WEO) projections for Norway cover the period through 2023. For the purpose of generating a complete baseline scenario as a basis for stress testing, these data are supplemented by asset price projections. Long-term projections (beyond 2023) rely on simple growth accounting. They assume that real mainland GDP growth would stabilize at around 1½–1¾ percent, driven by annual labor productivity growth of 1¼ percent and employment growth of 0.3–0.5 percent. The latter remains positive given Norway’s relatively high fertility rate and openness to immigration, which more than offsets continued declines in the labor force participation rate.<sup>24</sup> We base employment growth on the authorities’ labor force projections, which in turn are based on population projections combined with labor force participation rates of different genders, age groups, and persons of different migration background. Fiscal revenues are assumed to remain constant relative to mainland GDP and the expenditure ratio is assumed to vary only in response to aging costs. Annex II provides further details.

33. **Intertemporal financial net worth (IFNW) is our preferred indicator of long-run sustainability of current fiscal policies.** Negative IFNW is an indication that fiscal policies will need to be eventually changed to fulfill the budget constraint. Negative IFNW could also provoke adverse financial market reaction, if agents’ confidence deteriorates that policy adjustment would eventually be undertaken in the future. Compared to static net worth, IFNW excludes non-financial assets other than the value of remaining oil and gas deposits. This is preferable, in our view, to avoid double counting, given that most of these non-

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<sup>23</sup> On the upside, however, this allows for simulation of different policy and stress scenarios to gauge their effects on net worth measures (see Subsection C).

<sup>24</sup> See Figure II.1 for the projection of the labor force participation rate.

financial assets facilitate the generation of tax revenues by underpinning economic activity. While some public non-financial assets could be sold without large repercussions to economic activity (e.g., converting a public highway to a private toll highway), most are difficult or impossible to sell (e.g., in-city roads, sewage infrastructure, land in remote areas).<sup>25</sup> Selling buildings which house government agencies, schools, hospitals, police/fire stations, could be expected to negatively affect a country's institutional framework and lower future tax values (e.g., if it results in worse education via less schools or less rule of law via less courthouses). If buildings were sold and leased back, future expenditures would increase to (partly) offset income from the sale.

#### **A. IFNW under the Baseline and Comparison to Finland**

##### **34. Norway's IFNW is negative at close to -240 percent of mainland GDP.**

Norway's IFNW is driven down by a highly negative intertemporal component on the order of -450 percent of mainland GDP in 2017. The intertemporal component represents the present value (PV) of all future primary balances projected out to infinity,<sup>26</sup> adjusted for any items already covered in static net worth.<sup>27</sup> This adjusted primary balance results from the PVs of all future revenues (estimated at about 3,200 percent of mainland GDP) and of all future expenditures (estimated at about 3,650 percent of mainland GDP). About four tenths of the PV of future expenditures is related to aging costs.

**35. IFNW is sufficiently negative that good fortune alone is unlikely to push it above zero.** To reach a positive IFNW on good fortune alone, it would take a sizable "brightening up" of assumptions. While alternative assumptions are explored in Section III.C, it is telling that IFNW even during the oil boom years never reached positive territory, despite coming quite close. To put the IFNW magnitudes into more familiar terms, note that permanent savings of 1 percentage point of mainland GDP starting in 2024 would improve the intertemporal component—and thereby IFNW—by 60 percent of mainland GDP. Thereby, if a hypothetical one-time fiscal consolidation were implemented relatively soon, then savings of 4 percent of mainland GDP would be sufficient to bring IFNW to zero.

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<sup>25</sup> However, more professional management of public non-financial assets can generate value, as an emerging literature points out (e.g., Bova et al., 2013; Detter and Fölster, 2015).

<sup>26</sup> See Annex II for more details.

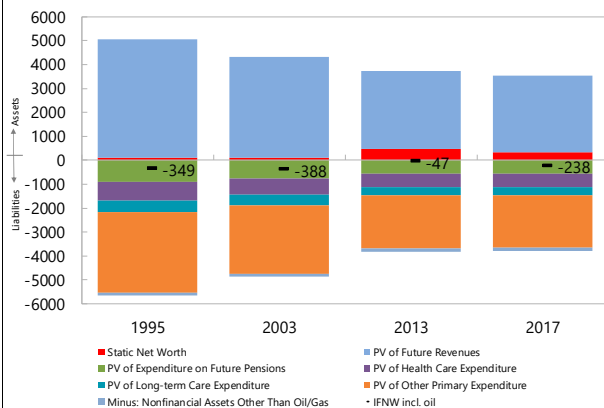
<sup>27</sup> Specifically, expenditures on existing pensions, as well as oil revenues and GPFG yields, are excluded from the adjusted primary balance measure.

**Figure 6. Norway's Intertemporal Public Sector Balance Sheet**

Norway's 2017 intertemporal financial net worth (IFNW) is negative, as the result of a highly negative intertemporal component. Even at the height of the oil boom IFNW remained slightly negative. Our IFNW measure excludes non-financial assets other than remaining oil/gas deposits, as most of these could not be easily sold off without hurting long-run economic activity and thereby fiscal revenue flows.

**Intertemporal Financial Net Worth by Components**

(Percent of mainland GDP)



Sources: Norwegian authorities and IMF Staff calculations and estimations.

Norway: Intertemporal Public Sector Balance Sheet (In Percent of mainland GDP)

	2017	
<b>A</b>	<b>Static Net Worth</b>	<b>341.7</b>
<b>G (=H-I)</b>	<b>Intertemporal Component 4/</b>	<b>-446.6</b>
<b>H</b>	PV of Future Revenues	3,205.5
<b>I</b>	PV of Future Primary Expenditures	3,652.1
	Expenditure on future pensions	568.6
	Health and long-term care expenditure	899.6
	Health care	548.5
	Long-term care	351.1
	Other primary expenditure	2,186.9
<b>L (=A+G-C-E)</b>	<b>Intertemporal Financial Net Worth, IFNW 5/</b>	<b>-237.9</b>
<b>Memorandum items:</b>		
<b>C</b>	GG Nonfinancial Assets other than oil/gas deposits	88.1
<b>E</b>	Public Corporations' Nonfinancial Assets	44.9
	Nominal mainland GDP (NOK billions)	2,803.8

Source: Authors' calculations and estimations based on various data sources (see Annex 1).

4/ The intertemporal component is the present value of future primary balances, where the underlying primary balance excludes expenditures for existing pension liabilities as well as oil revenues and GPFY yields, which are included in static net worth.

5/ Includes the present value of oil and gas in ground, because it can be quite easily monetized and—unlike sell-off of many other public sector nonfinancial assets—doing so would not affect non-oil revenues.

36. **A comparison with Finland's balance sheet is illustrative, as its static and intertemporal net worth are the reverse of Norway's** (Figure 7).<sup>28</sup> As discussed, Norway's static net worth is highly positive, but offset by a highly negative intertemporal component on account of present high non-oil deficits. In contrast, Finland has a negative static net worth of about 160 percent of GDP, but its intertemporal component is sufficiently positive to also turn its IFNW positive.<sup>29</sup> The reason behind this is that Finland has relatively low fiscal deficits of less than 2 percent of GDP and its medium-term fiscal framework includes reforms to reduce these further below 1 percent of GDP. In addition, within its expenditure envelope, it has already absorbed adverse aging trends over the last two decades, while Norway has so far benefited from positive aging trends (Figure 12).

37. **Norway's static net worth is broadly comparable to Finland's if oil-related wealth is excluded.** Oil-related wealth adds some 450 percent of mainland GDP to Norway's static net worth. Excluding it shows that the value of Norway's general government nonfinancial assets is closely comparable to that of Finland. Also, Norway's general

<sup>28</sup> Substantial efforts were made by the authors to ensure consistent treatment of data and long-term macroeconomic assumptions across the cases of Norway and Finland, although it cannot be precluded that, e.g., myriad data definitions could limit comparability somewhat.

<sup>29</sup> 2017 data for Finland are estimates from Brede and Henn (2017). At the time of their writing, actual data for 2017 was not yet available for Finland, but this is unlikely to change the comparison significantly.

government financial assets are higher purely on account of the GPFG. Notably, Finland also holds substantial financial investments through its social security funds, as it has a partially funded pension system while Norway’s is essentially pay-as-you-go. Given that Finland has been subject to more adverse aging trends already, its existing pension liabilities are higher (but its future pension liabilities lower). Both countries feature well-run and profitable public corporations, which add to public wealth—by about 10 percent of GDP in Finland and close to 50 percent of mainland GDP in Norway.

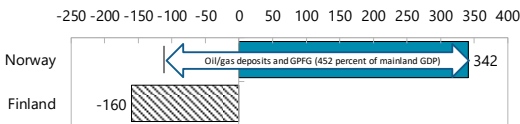
38. **Norway’s negative intertemporal component is driven mostly by high non-age related primary expenditure.** The PV of non-age related primary expenditures for Norway is close to 2,200 percent of mainland GDP, almost double that of Finland. While the PV of Norway’s future revenues is also higher, this can only compensate for only half of this additional expenditure. Future age-related expenditures are also slightly higher in Norway than in Finland, although Norway’s level of old age dependency is lower than that of Finland, partly due to higher fertility.

**Figure 7. Comparison of Norway and Finland’s Public Sector Balance Sheets**

*Norway’s static net worth is positive, while Finland’s is negative ...*

**Static Net Worth, 2017**

(Percent of mainland GDP for Norway; Percent of GDP for Finland)

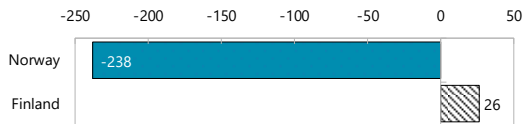


Sources: Norwegian Authorities, IMF Staff calculations and estimations, Brede and Henn (2018).

*... but the situation is reversed for the countries’ intertemporal financial net worth.*

**Intertemporal Financial Net Worth, 2017**

(Percent of mainland GDP for Norway; Percent of GDP for Finland)

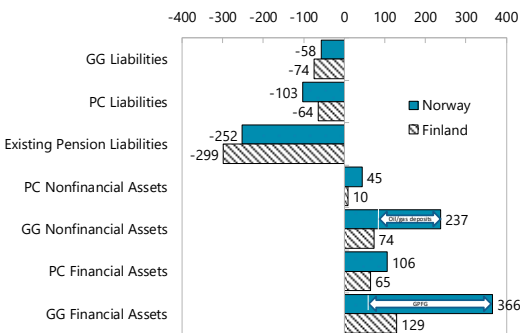


Sources: Norwegian Authorities, IMF Staff calculations and estimations, Brede and Henn (2018).

*The GPFG and present value of oil and gas in the ground explain the difference in static net worth.*

**Breakdown of Static Net Worth, 2017**

(Percent of mainland GDP for Norway; Percent of GDP for Finland)

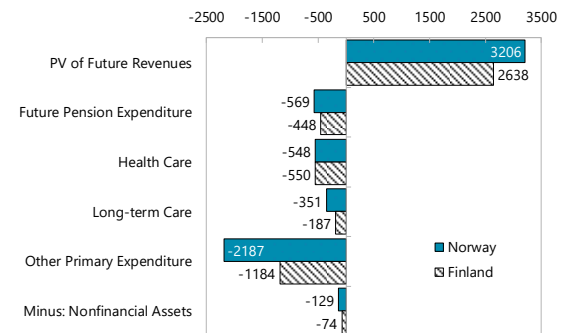


Sources: Norwegian Authorities, IMF Staff calculations and estimations, Brede and Henn (2018).

*Higher non-age-related expenditures drive Norway’s IFNW lower, while future age-related expenses are comparable.*

**Breakdown of the Intertemporal Component, 2017**

(Percent of mainland GDP for Norway; Percent of GDP for Finland)



Sources: Norwegian Authorities, IMF Staff calculations and estimations, Brede and Henn (2018).

## B. Stress Test

39. **An IFNW of zero may not be enough.** If only a zero IFNW is targeted, then any shock would again result in negative IFNW. Maintaining an IFNW buffer would be prudent to be able to withstand a shock with positive IFNW.

40. **Stress tests can provide a prudent benchmark level for IFNW.** They do so by answering the question how much a moderately severe shock would decrease IFNW. This section calibrates such a stress test for Norway and concludes that a buffer in the range of 25–95 percent of mainland GDP would be needed to withstand a severe shock with positive IFNW.

41. **For the stress scenario, we calibrate a moderately severe shock by taking an average of the two most recent crises Norway experienced** (Figure 8). These are the late 1980s Nordic Banking crisis and the Global Financial Crisis of 2008–09. In our calibrated shock real mainland GDP falls 5½ percent below the baseline. Compared to other countries, this shock may not seem very large. This is because macroeconomic volatility in Norway has been lower than in peers, partly on account of effective countercyclical policies. In addition, the impact of the GFC was not very strong in Norway, again because of countercyclical policies and as oil prices were high before the GFC and quickly rebounded to those levels by late 2009. We intentionally calibrate a somewhat larger shock for the stress test than that of the GFC. The stress test also assumes that, in 2019, global equity prices would fall by some 25 percent and housing prices by some 20 percent, set in line with major corrections in the past.<sup>30</sup> However, we assume some mean reversion after the crisis has passed, also in line with past experience. Annex III provides further details on the stress test calibration. Our stress tests do not consider contingent liabilities from the banking sector, because recent stress tests by the Norges Bank and the IMF show that Norwegian banks—in light of their high capital buffers—could withstand even very severe shocks with minimal need for recapitalization (see, e.g., IMF, 2015).

42. **An IFNW buffer of around 95 percent of mainland GDP would allow Norway to withstand a severe shock without the need for post-crisis fiscal adjustment** (Figure 9). To obtain this figure, we compare the IFNW measures of the baseline and stress without post-crisis policy adjustment scenarios in 2023, i.e. sometime after the crisis has passed. We do this to allow for the projected asset price recovery to materialize. In general, it would not seem advisable for policy makers to react to short-term fluctuations in IFNW driven by asset prices. We find that the 2023 IFNW absent any post-crisis policy adjustment would be 95 percent of

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<sup>30</sup> With regards to equity prices, the Shiller 10-year trailing price-earnings ratio is a much-watched measure of equity valuations. For US stocks, this measure stands currently more than 30 percent above its long-term average, suggesting that a 25 percent price correction is not unfathomable. During the GFC, global equities (as measured by the MSCI All-Country World Equity Index) experienced a larger than 50 percent peak-to-trough decline.

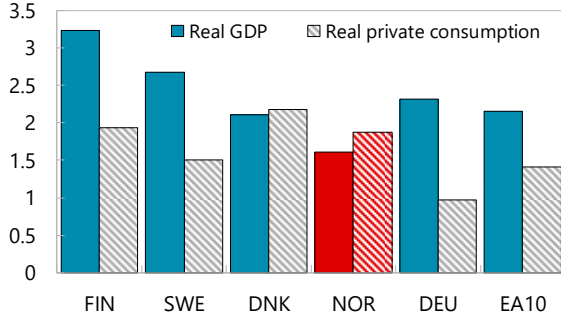
mainland GDP lower. Thus, an IFNW buffer of this magnitude would be sufficient for Norway to withstand a relatively severe shock without any need to adjust policies.

**Figure 8. Calibrating the Stress Test: Benchmarking Two Recent Crises**

*Macroeconomic volatility in Norway has been moderate compared to peers.*

**Volatility**

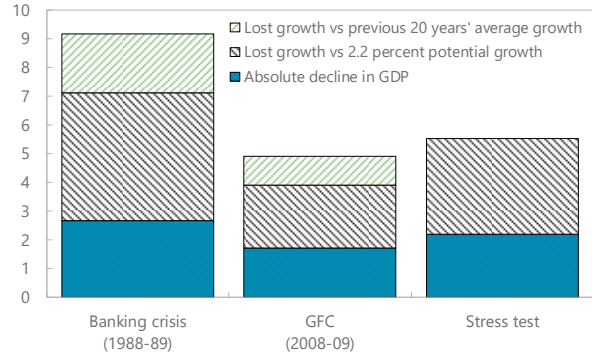
(Standard deviation of 2000Q1-2017Q4 y/y growth in percent)



Sources: Eurostat and Fund Staff calculations.

*Based on the last two crises, our moderately severe stress test envisages a 5½ percent fall in real mainland GDP compared to the baseline.*

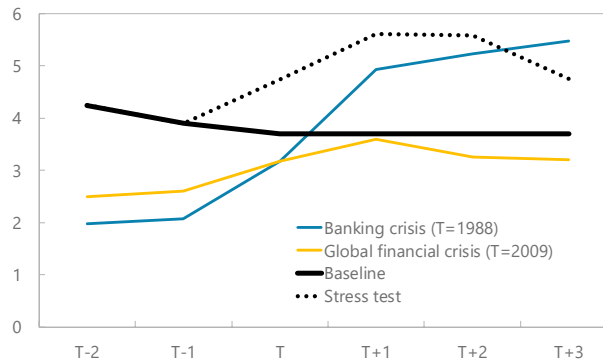
**Output Losses in the Last Two Crises and Stress test**  
(Percent of pre-crisis GDP)



Sources: Statistics Norway; and IMF staff estimates.

*Other macroeconomic variables are calibrated in line with the shock to mainland GDP and trajectories during the previous two crises.*

**Unemployment Rate in Historical Crises and Stress Test**  
(Percent)



Sources: Statistics Norway and IMF Staff estimates.

43. **An IFNW buffer of approximately 25 percent of mainland GDP would be sufficient to offset the deterioration in net worth of the crisis years, but would require post-crisis consolidation.** Such consolidation would be needed to return fiscal balances back to the baseline path after the crisis. We explore a variation of the stress scenario where fiscal consolidation is undertaken in 2024 to return the fiscal balance back to its baseline path. We find that IFNW would be 25 percent lower than the baseline under this assumption. This would thus be the prudent buffer required under the assumption that sufficient fiscal effort can be mustered to bring fiscal deficits back to the baseline after the crisis has passed.

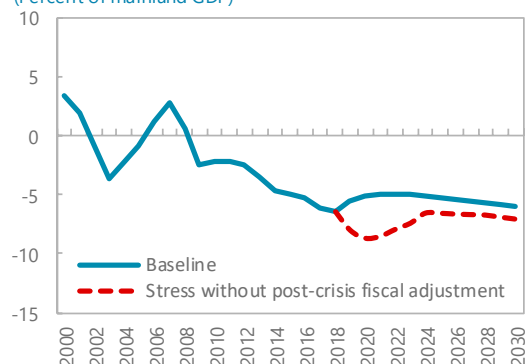


**Figure 9. Stress Test Results**

*Certain expenditures rise in line with factors other than mainland GDP, such as aging. Therefore—absent further adjustment—the primary balance would end up below the baseline after the shock.*

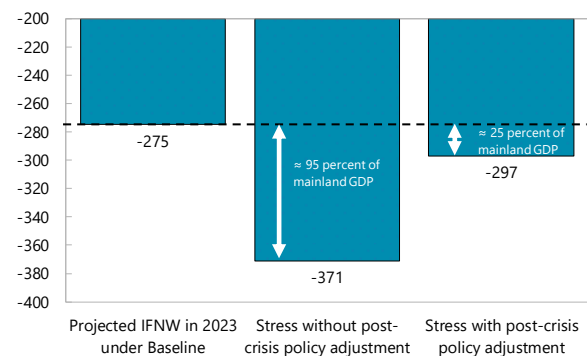
*A IFNW buffer of 95 percent of mainland GDP would allow Norway to withstand a relatively severe shock with positive IFNW and no need for post-crisis fiscal adjustment. A 25 percent of mainland GDP buffer would take care of the immediate effects of the shock, but some post-crisis adjustment would be necessary.*

**Nonoil Primary Balance: Case of No Post-Crisis Adjustment**  
(Percent of mainland GDP)



Sources: Statistics Norway and Fund Staff Estimates.

**Determination of the Size of a Prudent IFNW Buffer**  
(Percent of mainland GDP in 2023)



Sources: Fund Staff estimations.

### C. Scenario Analysis

44. **This section explores how Norway’s IFNW would change in response to two sets of assumptions underlying the analysis.** The first set of assumptions relates to the external environment, chiefly global asset and oil price developments. The second set of assumptions relates to variables that can be directly or indirectly influenced by domestic economic policies and provides insights on how Norway could bolster its IFNW. The scenarios mirror quite closely those in the latest Long-Term Perspectives report of the Norwegian authorities (Norwegian Government, 2017). The resulting implications for fiscal sustainability are comparable. The main difference is that our analysis integrates the scenarios in the balance sheet framework and can provide numerical impacts on IFNW.

45. **Exploring alternative assumptions on asset and oil prices illustrates the volatility underlying Norway’s static net worth (Figure 10).**

- **Higher/lower GPFY yields.** These scenarios suppose that the real long-term yield on the GPFY would be either 4 percent or 2 percent, instead of the 3 percent assumed by the baseline (and underlying Norway’s current fiscal rule). Since its inception, the GPFY’s real yield in krone terms has been 5.8 percent, so that a higher return could also be possible going forward (Figure 2). However, given strong performance, especially over the last years, global asset prices stand at high levels by some measures (Annex III). Therefore, also a lower return would be a possibility. The results of this scenario analysis illustrate that changes in yield would have a high impact on net worth, due to the large size of the GPFY. The lower 2 percent real yield would

decrease IFNW by 100 percentage points of mainland GDP to -339 percent of mainland GDP. Conversely, a 4 percent real yield would lift IFNW to -75 percent of mainland GDP.

- **Higher/lower GPFG asset stock.** These scenarios capture the impact of a one-off asset price correction to the upside or downside. They assume a one-time increase or decrease in the GPFG's value by 20 percent during 2018, while retaining the yield thereafter the same as in the baseline. Given that the GPFG's value at end-2017 was about 300 percent of mainland GDP, IFNW would rise or fall by 60 percent of mainland GDP under these scenarios.
- **Higher oil/gas production.** We simulate this as a one-sided upside scenario, because oil/gas production volumes have historically been underestimated, with production remaining higher for longer than expected (Figure 4). These repeated underestimations have been partly driven by larger resource discoveries than forecast but also by technological advances that allow for extraction of larger-than-expected quantities from existing fields. The baseline forecast assumes that from the late 2020s production volumes would go into a steady decline. This scenario instead assumes that production would remain around the present level until the end of the 2040s and only decline thereafter (in the same fashion as assumed in the baseline from 2030). The result would be an increase in IFNW of about 65 percent of mainland GDP.
- **Higher/lower oil/gas prices.** These scenarios suppose that there would be permanent increase or decrease in oil prices by 100 krone (about US\$12) from 2024 forward. Gas prices would also adjust correspondingly. This would boost or diminish IFNW by about 25 percent of mainland GDP. For Norway's IFNW to reach the lower end of the prudent buffer range on account of higher oil prices alone, the spot price per barrel would have to reach unprecedented heights (of about 180 U.S. dollars). These scenarios abstract from changes in the speed of extraction that may be caused by oil price changes. For instance, during times of high oil prices, extraction would likely be brought forward in time to take advantage of the high prices; this would increase the positive impact of the shock (Aleksandrov et al., 2013).

46. **On the one hand, this first set of scenarios suggests that policy action will likely be unavoidable.** For Norway to reach the prudent buffer range without policy action, the external environment would have to turn out considerably better than projected, likely with regards to more than one variable.

47. **On the other hand, it illustrates that policymakers will need to be sufficiently flexible to adapt to changing circumstances.** Given Norway's large exposure to asset and commodity prices, its IFNW can fluctuate substantially, even from year to year. Thus, policymakers should not react to short-term fluctuations in IFNW, but rather to longer-term shifts in IFNW that could reasonably assumed to be permanent. Norway's high static net

worth and strong institutions allow time to implement reforms, but it would seem prudent to bring them underway early. This would keep adjustment needs to reign in aging-driven pressures manageable if baseline assumptions turned out to be optimistic. If, on the contrary, the external environment turns out better than projected, fiscal policy could be gradually relaxed while safeguarding buffers.

48. **The second set of scenarios explores how different macroeconomic assumptions—on which domestic policies have some bearing—impact IFNW.** Naturally, to achieve higher IFNW, savings realized under the policy scenarios would need to be put towards improving the fiscal balance.

- **Higher/lower productivity.** The baseline assumes 1¼ percent annual economy-wide labor productivity growth from 2024 onwards. This scenario, in contrast, supposes a permanent increase or decrease in annual labor productivity growth of ½ percentage point relative to the baseline.<sup>31</sup> An increase could possibly be achieved through productivity-enhancing reforms, though it is beyond the scope of this paper to delve into further details.<sup>32</sup> If such higher productivity growth were achieved, Norway’s IFNW would come reasonably close to the zero threshold. In the adverse productivity growth scenario, IFNW would fall to -360 percent of mainland GDP.
- **Higher/lower employment.** In these scenarios employment growth rates are adjusted during 2024–60 to result in 10 percent higher or lower employment by 2060. Although Norway’s labor force participation rates remain high in international comparison, they have declined considerably after the GFC. Consequently, there could be some potential to increase employment, including among prime-age males, immigrants, and the disabled (Henn, 2017). Our estimation suggests that, if this were achieved, IFNW would increase by some 65 percent of mainland GDP, but still remain firmly in negative territory.
- **Higher/lower public sector efficiency.** This scenario is of particular interest, as the Norwegian authorities are actively exploring ways to extract more value for money in the provision of public services, including by putting in place a system of ongoing expenditure reviews. Under the baseline, annual growth in nominal non-pension expenditures is about 3¾ percent per year in most years after 2024. The scenario

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<sup>31</sup> We are conscious that there could be complex interactions of different variables in general equilibrium under all our scenarios, but we need abstract from them to keep our analysis tractable and straightforward. In the higher/lower productivity scenarios, as well as those on higher/lower employment, assume that provision of public services would increase (decrease) in response to a positive (negative) shock by half of the productivity/employment shock.

<sup>32</sup> The reader is referred to Section D on Structural Policies of the IMF 2018 Article IV Consultation Staff Report for Norway and to OECD (2018).

supposes that this annual growth rate would be reduced or increased by ¼ percentage point. If such, relatively small, efficiency gains can be achieved year after year, it would have a large positive impact on fiscal sustainability: in the upside scenario, IFNW would come close to the lower end of the prudent buffer range.

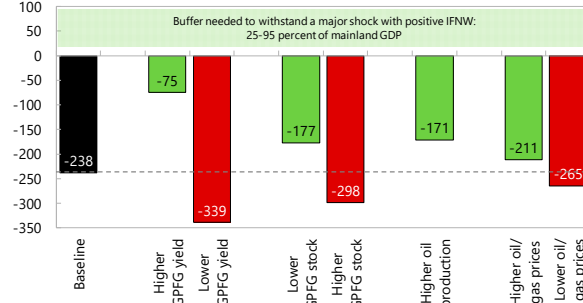
- Higher/lower health care costs.** The economic literature suggests that demand for and relative prices of social and health services could well increase more than envisaged due to higher relative demand and lower relative productivity in health services (Andersen et al, 2007).<sup>33</sup> In the baseline, nominal health care costs increase by 4½ percent annually during 2024–53, when aging pressures are most intense. The adverse scenario assumes an additional 1 percentage point nominal growth in health care costs. Meanwhile, the upside scenario assumes that growth could be lowered by the same amount. Impacts on IFNW are substantial—this illustrates that it will be important to closely control health care costs over the next decades. In the adverse scenario, IFNW would decline by about 135 percent of mainland GDP to -372 percent of mainland GDP. In contrast, in the upside scenario, IFNW would be -77 percent of mainland GDP. Analysis on Finland, which is currently in the process of legislating health care reform, highlights that savings in this area can make a fundamental contribution to fiscal sustainability (Brede and Henn, 2018).

**Figure 10. Scenario Analysis**

*Good fortune alone with respect to the external economic environment would be unlikely to lift IFNW to the prudent buffer range.*

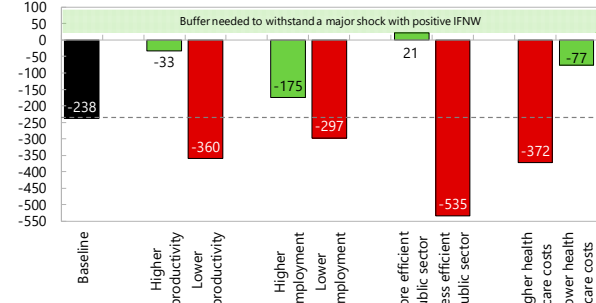
*However, achieving efficiency improvements in public services provision would have a strong impact on IFNW, if savings are used to improve future fiscal balances.*

**IFNW under Alternative Assumptions on Oil and the GPFG**  
(Percent of mainland GDP)



Sources: Fund Staff projections and calculations.

**IFNW under Alternative Macroeconomic Assumptions**  
(Percent of mainland GDP)



Sources: Fund Staff projections and calculations.

<sup>33</sup> Wagner’s law suggests that demand for some welfare services tends to increase faster than income and Baumol’s law suggests that productivity in production of welfare services tends to increase at a lower rate than in production of goods and other services. While demographic projections attempt to account for these effects, they may prove stronger.

#### D. Fiscal Paths and Policy Options in Light of Aging

49. **Credible commitment to the 3-percent rule would guarantee long-run fiscal sustainability.** It would also generate an IFNW buffer in the prudent range: We compute that it would imply an IFNW of 44 percent of mainland GDP. However, backloading of consolidation under the rule implies that agents may require more reassurance through Norway's institutions that such consolidation, as envisaged under the rule, would ultimately be undertaken.

50. **The rule implies very limited consolidation over the next 15 years, when aging pressures are most intense, at the expense of steeper consolidation later** (Figure 11). The baseline fiscal path, which assumes no policy actions, implies an IFNW of about -240 percent of mainland GDP, as discussed. This path could be accommodated under the 3 percent fiscal rule until 2029. The rule would then require consolidation in step with aging pressures until the early 2040s.<sup>34</sup> Thereafter, the rule would imply consolidation in excess of age-related spending increases.

51. **Containing fiscal deficits earlier would reduce need for future fiscal action.** In addition, reducing the footprint of the public sector earlier could help maintain competitiveness, which is a vulnerability after two decades of wage increases well ahead of productivity, although terms of trade improvements provided breathing room (Cabezon and Henn, 2018).<sup>35</sup> It is illustrative to note that permanent fiscal adjustment of 1 percent of mainland GDP by 2024 would improve IFNW by 60 percentage points of mainland GDP. Consequently, a hypothetical one-time consolidation of 5 percent of mainland GDP by 2024 would put Norway into the middle of the desirable buffer range and preempt aging pressures, i.e. no further consolidation would be required later.<sup>36</sup>

52. **Gradually consolidating earlier—by 2 percent of mainland GDP or so— would also result in a more stable intertemporal fiscal path.** Phasing in such a consolidation over the medium term would likely lead to the most stable fiscal path. The current upcycle provides an opportunity to make some gradual headway by partly reversing the considerable fiscal stimulus (2½ percent of mainland GDP) induced during 2014–17 to cushion the oil downturn. Over the medium term, further savings could be achieved, for instance, by keeping

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<sup>34</sup> To see this, note that the blue line in the left chart of Figure 11 is horizontal during this period, while the red line increases as a result of rising age-related spending.

<sup>35</sup> Note that recent IMF staff reports for Norway also suggest that the country's external position is weaker than implied by medium-term fundamentals and desired policies; see e.g., IMF (2017).

<sup>36</sup> If the fiscal deficit were allowed to evolve in line with aging costs for another decade (until 2034) before such a one-time permanent consolidation, then this consolidation would have to be 0.6–0.7 percent of mainland GDP larger to reach an IFNW of 60 percent of mainland GDP. If no fiscal action at all were taken, Norway's savings would fall below 60 percent of mainland GDP by the late 2050s and become negative by the early 2060s; in addition, the non-oil fiscal deficit would at that time exceed 15 percent of mainland GDP.

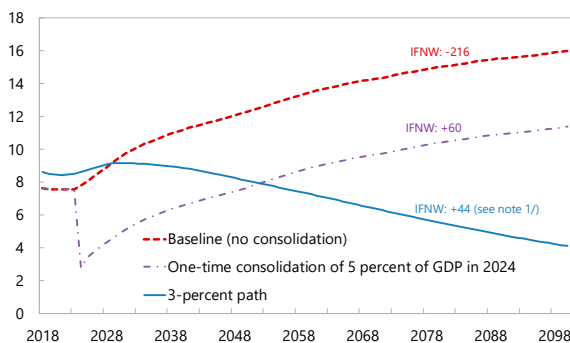
expenditure growth below nominal GDP growth for some years by realizing (and saving) efficiency gains in public services provision. Improving public sector efficiency is a firm objective of the Norwegian authorities; a system of regular public expenditure reviews—currently being envisaged—could help. Such a gradual 2 percent of mainland GDP consolidation would reduce non-oil deficits to around 5½–6 percent of mainland GDP and these could be maintained over this century, assuming baseline assumptions materialize, while retaining IFNW in the prudent buffer range. In other words, any further consolidation would only have to offset increases in aging cost. Consolidation needs would be lower than under the 3-percent rule starting from the mid-2030s.

**Figure 11. Fiscal Paths, Implied IFNWs, and Aging Costs**

*Adhering to the 3-percent path ad infinitum would ensure intertemporal fiscal sustainability. A—purely illustrative—5 percent of mainland GDP one-time consolidation by 2024 would also jolt Norway’s IFNW to the prudent buffer range.*

*The 3-percent path implies no consolidation until 2029, but thereafter the rule would require consolidation to proceed faster than age-related cost increases.*

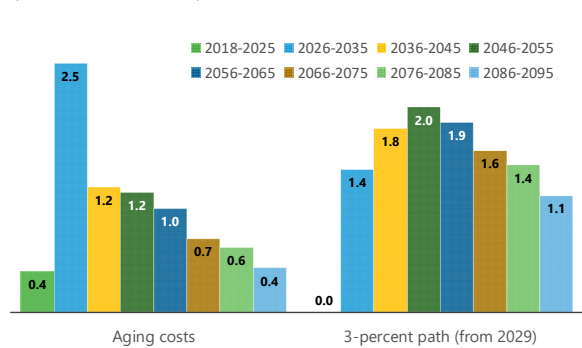
**Alternative Non-oil Fiscal Deficit Paths and implied IFNW**  
(Percent of mainland GDP)



Sources: IMF Staff projections.

1/ Baseline until 2028; then adhere to 3 percent rule after it binds from 2029 onwards.

**Aging Cost and Consolidation under 3-percent Path**  
(Percent of mainland GDP)



Source: Norwegian Authorities and Fund Staff projections.

**53. Benchmarking of Norway’s current primary spending to that of other countries can help identify areas with savings potential** (Figure 12). When measured in percent of its overall GDP (including oil), Norway’s primary expenditure stands moderately below the average of the three other Nordic countries.<sup>37</sup> However, the ratio relative to mainland GDP is also good to keep in mind because it illustrates where Norway would stand after oil production ceases. On that measure, Norway’s primary expenditure is currently 7½ percent of mainland GDP higher than that of other Nordics. This is important to note, because virtually all expenditures nowadays are unrelated to oil extraction, implying that they would not automatically tail off in line with oil production.

<sup>37</sup> Given that oil production in Norway is expected to remain high for some time, total GDP seems to be the most appropriate normalization for cross-country comparison at present.

54. **Spending on general public services is in line with the Nordic average, but transport spending stands out.** Spending on transport is by more than 1 percent of GDP higher than in Nordic peers. While Norway's more mountainous topography may justify somewhat higher spending, there may be potential to realize some savings in this area.

55. **Social spending is below the Nordic average, but spending on disability and sickness is very high.** Social spending is lower, because pension spending is still low. This in turn is due to Norway having benefited from a benign aging trend over the past two decades, in contrast to peers. However, spending on sickness and disability is very high (at 8 percent of mainland GDP) and exceeds peers by a large margin. This is partly due to eligibility criteria for disability pensions remaining quite lax in Norway, despite incremental tightening in the past years (Henn, 2017). As a result, disability has traditionally been used an early retirement pathway and recently disability incidence has also been increasing among younger people. Other Nordic countries have progressed considerably more in this area over the past decades, which has helped them to contain spending.

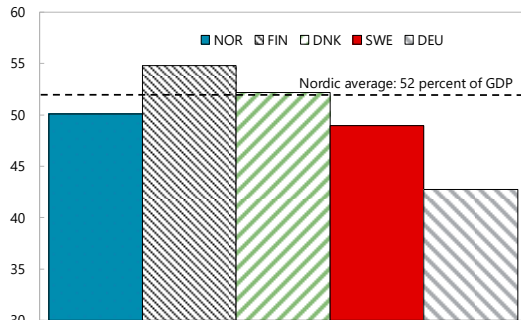
56. **Health care expenditures exceed the Nordic average, despite Norway having relatively fewer old people.** Norway spends 1 percentage point of GDP more on health care than other Nordics on average. This seems to be driven largely by the high cost of hospitalizations in Norway.

**Figure 12. Norway: Primary Expenditure Composition and Aging**

Norway's fiscal expenditure ratio is about 2 percentage points of GDP lower than that of Nordic peers, when measured in percent of total GDP (including oil production).<sup>1/</sup>

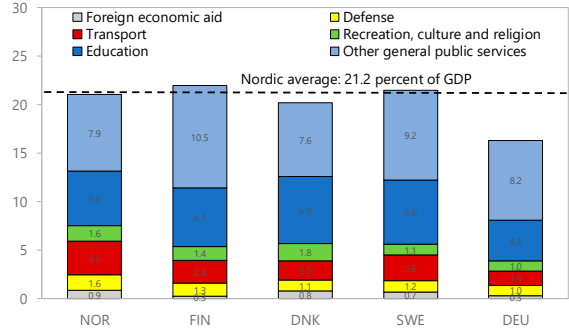
Norway's expenditure on general public services is in line with other Nordics, although transport and defense spending is higher.

**General Government Primary Expenditure, 2016**  
(Percent of GDP)



Sources: Eurostat, IMF World Economic Outlook, and Fund staff calculations.

**Expenditure on General Public Services, 2016**  
(Percent of GDP)

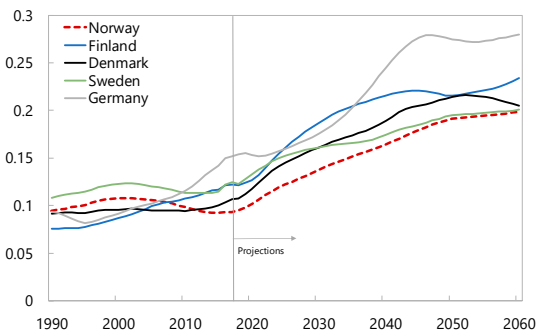


Source: Eurostat, IMF World Economic Outlook and IMF Staff calculations. General public services are defined here as COFOG categories 01-06 and 08-09.

Unlike in some peers, the dependency ratio in Norway has not increased yet, but this is about to happen ...

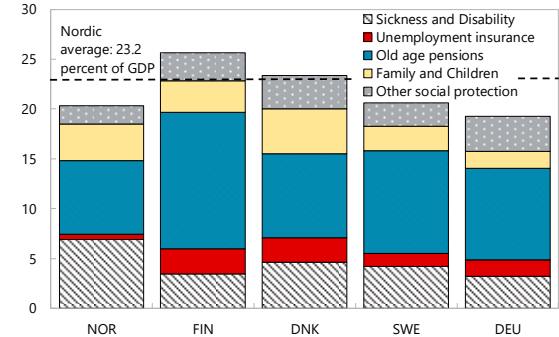
... so pension spending is lower for now than in peers, but spending on sickness and disability is significantly costlier.

**Old Age Dependency**  
(Ratio of population aged 75+ to those aged 15-74)



Sources: National Statistics Institutes, United Nations, Haver, Fund Staff calculations.

**Social Expenditure, 2016**  
(Percent of GDP)

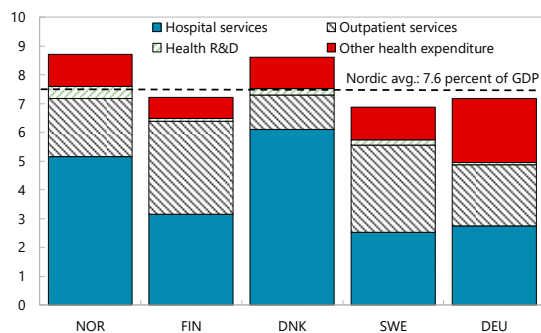


Sources: Eurostat, IMF World Economic Outlook, and Fund Staff calculations.

Despite fewer old-age people, Norway's health spending is higher than most peers, partly due to higher domestic wages and preferences for decentralized provision of services.

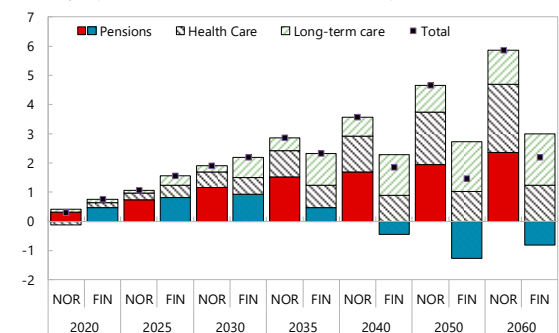
As aging progresses, related expenditures are forecast to rise more than in Nordic peers.

**Public Health Care Expenditure by Category, 2016**  
(Percent of GDP)



Sources: Eurostat, IMF World Economic Outlook, and Fund Staff calculations.

**Increases in Age-Related Expenditures**  
(Norway: in percent of mainland GDP versus 2017; Finland: in percent of GDP versus 2015)



Sources: Norwegian Authorities, Finnish Ministry of Finance (2017) and Fund staff calculations.

<sup>1/</sup> Normalized by total GDP for more accurate cross-country comparison. If expressed as a percentage of mainland GDP, primary expenditure in Norway would be 7½ percentage points higher than in Nordic peers.



#### IV. CONCLUSION

57. **The public sector balance sheet approach provides a comprehensive tool to assess long-run fiscal sustainability.** The static public sector balance sheet analysis expands the analysis beyond debt by adding government assets, balance sheets of public corporations, and existing pension liabilities. The intertemporal balance sheet also includes present values of all future fiscal balances, bringing together all stocks and flows in a single comprehensive framework. It provides the measure of intertemporal financial net worth (IFNW), which is equivalent to the public sector's intertemporal budget constraint. If IFNW stands considerably below zero and agents lose confidence in a government's ability to implement reforms in the future, an adverse market reaction could be a possibility. While governments should abstain from immediate policy reactions in response to asset price-induced plunges in net worth, they should stand ready to act if net worth stays persistently depressed. This is particularly pertinent for Norway, whose net worth is highly affected by asset and oil price fluctuations.

58. **The public sector balance sheet approach shows that Norway has not oversaved—instead further actions will ultimately be needed to address aging pressures.** The permanent income hypothesis approach by Gagnon (2018) assumes that spending in each period should in essence be equal to achieve intergenerational equity. However, it does not consider aging as a result of which spending later in time may best benefit the present generation, as it comes when its needs are highest. Our balance sheet approach incorporates aging effects and also expands the analysis beyond oil revenues to all public sector assets and liabilities. We find that Norway's IFNW is about -240 percent of mainland GDP. This is because the nonoil deficits are already large at present, although aging is only commencing, which more than offsets Norway's large static net worth (of some 340 percent of mainland GDP).

59. **For Norway, a positive intertemporal financial net worth in the range of 25-95 percent of mainland GDP would be desirable.** A buffer at the lower end of this range could absorb the immediate impact of a large shock, while maintaining positive intertemporal financial net worth. Nevertheless, it would require fiscal adjustments after the crisis to bring fiscal balances back onto the projected baseline. A buffer of 95 percent of mainland GDP would be sufficient to weather a large shock without need for subsequent fiscal adjustment, while maintaining a positive intertemporal financial net worth.

60. **Norway's fiscal rule ensures long-run fiscal sustainability.** We find that the IFNW implied by adhering to the rule ad infinitum lies within the prudent buffer range at 44 percent of mainland GDP. The switch in 2017 from a 4 percent to a 3 percent rule, which was undertaken in response to the recommendations of the Thøgersen commission (Norwegian Government, 2015), is very favorable: It stabilizes the fiscal path considerably over the next two decades.

61. **However, anticipating aging pressures by undertaking some fiscal consolidation earlier would lower future adjustment needs and result in an even more stable fiscal path.** While avoiding a further loosening of fiscal policies, the 3-percent rule envisages little

consolidation over the next fifteen years—when aging pressures are most intense. In return, it implies that consolidation has to exceed increases in aging costs thereafter. Undertaking some consolidation earlier would achieve three favorable implications: (i) it would send an earlier signal that fiscal policy is committed to maintaining IFNW in the prudent buffer range; (ii) it would generate an even more stable long-term fiscal path and reduce needs to realize savings in the future; and (iii) it should help keep competitiveness concerns at bay by helping to contain wage pressures and by reducing the footprint of the government on the economy (Cabezon and Henn, 2018). While Norway—with its large assets and strong institutions—undoubtedly would have the luxury to put off consolidation, economic upswings, such as the one currently underway, would seem to provide a good opportunity to make headway.

**62. Enhancing public sector efficiency, including by exploring savings potential in specific areas, and keeping a vibrant economy would safeguard fiscal sustainability.** Our scenario analysis suggests that relatively small but continuous efficiency improvements in public services and health care delivery can have large impacts on fiscal sustainability. The Norwegian authorities' interest in enhancing value for money in public services is well taken and realized savings, if banked, would increase IFNW. Benchmarking versus peers suggests potential for fiscal savings in several areas, including transport, disability allowances, and health care spending. Finally, it is paramount for policies to continue to underpin high employment and productivity, including by enhancing work incentives and incentivizing innovation. Doing so should enable Norway to continue to generate needed revenues to underpin its social model.

**63. Forthcoming balance sheet analyses for more countries will help put Norway in better international perspective.** Comparison to Finland was already possible based on our previous work (Brede and Henn, 2018). It shows that Finland's IFNW is slightly positive, while Norway's is negative. A surprising result at first sight, but intuitive given Finland's much lower fiscal deficits and the fact that it has already absorbed some aging pressures. The IMF's October 2018 Fiscal Monitor (IMF, 2018) will provide static balance sheets for a larger series of countries, which will be informative. It is our hope that their and our work be sufficiently appreciated to incentivize governments to put in place proper reporting systems to enable them to compile such balance sheets and use them in charting their fiscal paths.

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## ANNEX I. STATIC PUBLIC SECTOR BALANCE SHEET—DATA AND METHODOLOGY

1. **Constructing a public sector balance sheet is data intensive.** Even for an advanced country like Norway with very good data reporting, it requires gathering and consolidating data from various sources. In addition, we relied on extensive assistance from the Norwegian authorities. This annex provides the details on the data and methodology used.
2. **The static PSBS results mostly from a compilation of historical data, but some estimations and adjustments were nonetheless necessary.** Norway's very good data availability favors a data-intensive exercise like the construction of a PSBS. However, in some areas adjustment and estimations were required to construct the static PSBS in the format presented and to avoid double counting; this section provides the underlying technical details.

### Non-financial assets

3. **To derive the value of non-financial assets, we use Statistics Norway's data on fixed assets, which we supplement with the value of land holdings.** Time series data on the total value of general government fixed assets are available through 2017 (Statistics Norway Table 09181), while a breakdown by asset type is available through 2015 (Statistics Norway Table 11189). However, data on the value of land holdings is only available for the period 2012–14 from Eurostat; it has lower reliability and Statistics Norway is currently working on improving these data. We nonetheless include the existing data, which suggest land holdings were worth about 12 percent of mainland GDP in 2014.<sup>1</sup>
4. **Valuation issues are a caveat to bear in mind.** The inclusion of government assets, and non-financial assets in particular, raises various accounting issues. Valuation of non-financial assets—mainly land, buildings, roads, other network infrastructure can be difficult (historical costs, market value or replacement costs) and subject to variation across countries.<sup>2</sup> For Norway, their valuation basis is that of depreciated replacement cost at market prices.<sup>3</sup> It is also important to bear in mind that speedy liquidation of those assets might be

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<sup>1</sup> We extrapolate data for the years before and after 2012–14 by assuming that the value of land holdings would remain constant as a percentage of mainland GDP.

<sup>2</sup> The same applies to a lesser extent also to financial assets.

<sup>3</sup> This applies to the data reported for the general government in Statistics Norway Table 11189, which also uses the Perpetual Inventory Method (PIM) to estimate capital stock of fixed assets and consumption of fixed capital. Valuation of fixed assets in of public corporations from Statistics Norway Table 07865 are collected directly from the enterprises' accounts themselves. Most corporations use The Accounting Act of 17th June 1998 and the Norwegian Accounting Standard. Valuation of fixed assets are assumed to be close to purchasers' prices at acquisition reduced by accumulated depreciation.

difficult, particularly in a crisis situation, and more so if a subnational entity of the government is the owner.<sup>4</sup>

**5. We supplement the data on non-financial assets by the present value of oil and gas reserves.** On the non-financial asset side, the readily-available data comprise non-resource non-financial assets, mainly government buildings, infrastructure and land. For Norway, it is, however, important to also include in static net worth an estimated present value of oil and gas reserves remaining in the ground. To compute the present value at end-2017 and in future years, we use estimates on state net cash flows from petroleum production through 2085 provided by the Norwegian Ministry of Finance.<sup>5</sup> For 2016 and before, we compute this present value by taking a time series of projected petroleum production volume from the Norwegian Petroleum Directorate's Resource Reports and multiplying by oil and gas prices from the corresponding vintage of the IMF World Economic Outlook projections.<sup>6</sup> The total value of petroleum production in each year is then translated into the state's net revenue from petroleum activities by using historic ratios observed between these two variables. Finally, to compute the present value, we use our 5 percent discount rate.

**6. When including the present value of oil and gas reserves, we are aware of possible double counting.** The Norwegian government holds a State Direct Financial Interest (SDFI), i.e. a direct participation, in the extraction of oil. Given that we already account for the present value of all revenue flows from oil and gas, we therefore need to take out the value of oil production licenses of the SDFI.<sup>7</sup> These are reported as a part of government's financial assets under equity investments (in Statistics Norway Table 10788) and valued at 7 percent of mainland GDP in 2017. We also examined the balance sheet of Equinor, the majority publicly-owned oil/gas corporation, and found that it does not include any value of the oil/gas directly. Assets listed relate largely to the extraction infrastructure,

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<sup>4</sup> A separate strand of literature (e.g. Bova et al., 2013) highlights that the analysis of the operations of non-financial assets is important since a change in management of those existing assets could improve the budget balance.

<sup>5</sup> These data also underlie the 2018 Revised National Budget of Norway and assume oil price of around US\$60, specifically of 519 NOK per barrel in 2018 and NOK 484 in 2019. While the July 2018 WEO update would increase prices in 2018 and 2019 by about 15 and 5 percent, respectively, long-run prices from the early 2020s onwards are actually projected slightly lower than in the April 2018 WEO. Thereby, deviating from the Ministry's projections to reflect the latest oil price uptick observed in May/June 2018 would not materially change our results. Finally, we assume that petroleum production would cease in 2090; we use linear interpolation to derive estimates for oil revenues for the years between 2085 and 2090.

<sup>6</sup> For example, to compute the present value of remaining oil and gas resources in 2011, we use the average of the oil/gas price forecasts of the April 2011 and October 2011 WEO assumptions. Oil and gas price projections from WEO are available for five years into the future. Thereafter, we suppose that nominal oil and gas prices evolve in line with advanced economies' CPI inflation.

<sup>7</sup> While these assets are managed by [Petoro AS](#), a public corporation, the value of the licenses is nonetheless included in general government financial assets in Statistics Norway's source data. We thank Frode Borgas at Statistics Norway for highlighting this issue.

including platforms. We recognize that some of these assets would be worth much less after all oil/gas is extracted. However, Equinor's equity likely reflects value going beyond this, including participations in activities abroad and its human capital, which could be redeployed over time.<sup>8</sup> Therefore, we do not correct the value of public corporations for the value of the government's 67 percent stake in Equinor. With the stake valued at 12.7 percent of mainland GDP at end 2016, this does not change our conclusions.

### **Financial assets and liabilities**

**7. Data on general government financial accounts are readily available for Norway, but some adjustments were required to construct the balance sheet.** Detailed consolidated financial accounts data for the general government are taken from Statistics Norway (Table 10788) and Eurostat.

**8. For the data on financial assets, we add a breakdown into assets held by the GPFG and the general government at large.** The data from Statistics Norway and Eurostat provide the total value of general government financial assets, which include those managed in the GPFG. However, to facilitate our analysis and to improve presentation we add a breakdown into GPFG and other general government financial assets. The data on GPFG asset holdings are taken from Norges Bank Investment Management, who administer the fund.<sup>9</sup>

### **Public corporations**

**9. We collect balance sheet data on public corporations and the Norges Bank.** Data on the assets and liabilities of non-financial public corporations are readily available from Statistics Norway (Tables 07865 and 05419) from 1999 onwards. To complete our time series of balance sheets back to 1995, we extrapolate assets and liabilities of non-financial public corporations for 1995–98 by maintaining them constant as a percentage of mainland GDP at their 1999 value. Notably, these data are not consolidated among public enterprises or between public enterprises and general government. Although we do undertake some consolidation for general government equity holdings in public enterprises (see below), it is incomplete. This implies that our values of total public sector assets and liabilities would be inflated, but fortunately, net worth measures are unaffected. Finally, we also add information on the Norges Bank's assets and liabilities, based on its annual reports and the IMF Monetary and Financial Statistics.<sup>10</sup>

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<sup>8</sup> That Norway has built a sizable oil services export industry over the past decades suggests that a gradual redeployment of know-how could be possible.

<sup>9</sup> See <https://www.nbim.no/en/the-fund/market-value/>

<sup>10</sup> See <https://www.norges-bank.no/en/Published/Publications/Annual-Report/>



10. **Financial public corporations were not considered separately.** While there is a number of publicly-owned or controlled financial corporations outside the central bank, Statistics Norway does not publish balance sheet data for all the units as a separate sector due to resource constraints. However, these institutions are relatively small.<sup>11</sup> While the government does hold a 34 percent stake in DNB, the largest domestic bank, it does not exert active control over the institution and it therefore does not form part of the public corporations' sector.<sup>12</sup>

### Existing pension liabilities

11. **Pension liabilities are partly included in the static balance sheet and partly in the intertemporal component of the balance sheet.** We obtained data on projected total pension expenditures through 2100 directly from the Norwegian Ministry of Finance.<sup>13</sup> These were then split into “existing” pension liabilities, which are included in the static balance sheet, and “future” pension liabilities, which are included in the intertemporal component of the balance sheet. Existing pension liabilities pertain to work performed up to the present and constitute liabilities already at the present moment; they are therefore included in the static balance sheet. Meanwhile, future pension liabilities arise from work performed from this point forward and are therefore included in the intertemporal component of the balance sheet. Statistics Norway provided us with an estimate of how much of all future pension expenditure in each year from 2018 onwards relates to work performed up to 2017.<sup>14</sup> These data are used to compute the present value figure for existing pension in 2017. To obtain the present value of existing pension liabilities for years other than 2017, we used the same profile of existing to total pension expenditures emerging from the data provided by Statistics Norway, as displayed in the chart in Section II.B.<sup>15</sup> Note that these assumptions on the

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<sup>11</sup> Limited data are reported for a subset, “state lending institutions” (Statistics Norway Table 09564). These data show that total loans given by these institutions amounted to 12 percent of mainland GDP at end 2017.

<sup>12</sup> As the government does not exert control over DNB, this stake is included as an equity investment in general government assets.

<sup>13</sup> We are grateful to Siri Wingard at the Norwegian Ministry of Finance for providing these data.

<sup>14</sup> We are much indebted to Dennis Fredriksen and Nils Martin Stølen at Statistics Norway for providing us these data. They made these data available in 2015 constant prices. To inflate the data, we note that pensions in Norway are adjusted by wage increases minus 0.75 percentage points, and we assume that future wage increases would be in line with the sum of inflation and labor productivity growth.

<sup>15</sup> For instance, existing pension liabilities accrued until 2017 account for 96 percent of all pension expenditure for 2018 (and the remaining 4 percent pertain to pensions of persons retiring in 2018). Thus, 96 percent of total 2018 pension expenditure enters in the computation of the 2017 present value of existing pension liabilities. Then, in computing the 2018 PV of existing pension liabilities, we assume likewise that 96 percent of 2019 total pension expenditures pertain to pensions accrued until 2018.

breakdown of pension liabilities into existing and future do not affect intertemporal net worth measures, as the latter only depends on the sum of existing and future pension liabilities.

12. **To obtain present values of future pension liabilities, assumptions on an appropriate discount rate need to be made.** This rate is used to discount all future payment streams back to the present. As in our work on Finland (Brede and Henn, 2018), we use a nominal discount rate of 5 percent. This seems appropriate as the inflation target of the Norges Bank (and many other advanced country central banks) is 2 percent and the real long-term return on a balanced asset portfolio could be expected to lie around 3 percent. On the latter, extensive studies have been carried out by the Norwegian authorities to determine an expected real return on the GPFG's balance portfolio (see Norges Bank, 2016, and references therein).

### **Consolidation**

13. **Consolidation is intended to eliminate cross-holdings between the different entities that make up the public sector.** Consolidation eliminates those liabilities of one public sector entity that are held as assets by another, thereby shortening the public sector balance sheet but not affecting net worth measures. Performing consolidation requires more detailed information on borrower-lender relationships between the different entities. The public sector is composed of general government, public sector corporations, and the central bank. Consolidation can take place across these subsectors or within these subsectors.

14. **Within-subsector consolidation is only an issue for public corporations.** Within general government, consolidation has already been performed by Statistics Norway in their preparation of general government statistics by eliminating cross-holdings between different entities of central (CG) and local government (LG). Likewise, such consolidation is not an issue for the central bank, because it is a single entity. Only for public corporations, the data reported by Statistics Norway are not consolidated amongst them. Unfortunately, there is also no information on creditor-debtor relationships among them, which would enable such consolidation. As a result, both assets and liabilities of the public corporations' sector are likely inflated, but this does not affect the net worth measures that are of our primary interest.

15. **As far as available information allows, we perform consolidation across the subsectors of the public sector.** Specifically, we consolidate five items:

- **Equity of CG-owned public corporations.** We exclude the equity of central-government-owned public corporations from the liabilities of public corporations and the equity investment assets of general government. In 2017, this reduces both these items by NOK 840 billion (30 percent of mainland GDP). Data on the CG's equity holdings in public corporations are obtained from the State Ownership Reports (Norwegian Ministry of Trade, Industry and Fisheries, various years).

- **Equity of LG-owned public corporations.** Again, this equity is excluded from both the liabilities of public corporations and the equity investment assets of general government. In 2017, this reduces both these items by NOK 78 billion (3 percent of mainland GDP). Data on the LG's equity holdings in public corporations were obtained from Statistics Norway for 2015–17.<sup>16</sup> Their value is extrapolated back in time using the same growth rate as that observed for the CG's equity holdings in public corporations.
- **Equity of the central bank.** Once more, this equity is excluded from both the financial liabilities of public corporations and the equity investment assets of general government. In 2017, this reduces both these items by NOK 252 billion (9 percent of mainland GDP). Data on the equity of the central bank are taken from the IMF's Monetary and Financial Statistics.
- **General government deposits at the central bank.** These are eliminated from general government financial assets and financial liabilities of the central bank. In 2017, this reduces both these items by NOK 163 billion (6 percent of mainland GDP). Data on these deposits are taken from the IMF's Monetary and Financial Statistics.
- **General government securities held by the central bank.** The central bank has not been holding government securities since 2004, but held limited amounts before then. For the years before 2004, these are eliminated from general government financial liabilities and financial assets of the central bank. For 2003, this reduces both these items by NOK 23 billion (2 percent of mainland GDP). Data on these deposits are taken from the IMF's Monetary and Financial Statistics.

16. **Finally, one more elimination is made to avoid double counting.** This elimination is not consolidation in a proper sense, because we are not eliminating cross-holdings of assets and liabilities. It relates to the value of petroleum production licenses which are held by the State Direct Financial Interest, the Norwegian government's direct participation in petroleum production activities. The value of these licenses (of 7 percent of mainland GDP in 2017) is included in general government equity assets by Statistics Norway. However, we eliminate this from general government equity assets in our analysis to avoid double counting, because we already include a present value estimate for all future government revenues from remaining oil and gas deposits.

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<sup>16</sup> We thank Frode Borgas at Statistics Norway for making these data available.

## ANNEX II. PROJECTIONS UNDERLYING THE INTERTEMPORAL BALANCE SHEET

### Medium-Term Projections (through 2023)

1. **A baseline forward projection of the balance sheet is necessary to facilitate stress testing.** The standard set of variables regularly projected by IMF country teams as part of the World Economic Outlook (WEO) provide a good basis for this projection, but some further assumptions are also necessary.
2. **We construct the baseline projection of the PSBS as follows.** To project the public sector balance sheet forward to 2023, we use the macroeconomic framework underlying the April 2018 WEO, only making minor updates to reflect latest developments up to May 2018. Table 3 summarizes these projections for key variables. Over the medium-term, real mainland GDP is projected to grow by 2–2½ percent annually. Employment growth would remain healthy at around 1 percent per year, returning the unemployment rate to an estimated NAIRU of 3¾ percent in the near future. In addition to the variables routinely projected by IMF country teams, we need to make some further assumptions to be able to project the asset and liability stocks of the balance sheet.
3. **Regarding future asset and liability transactions, we make the following assumptions.**
  - **General government (GG) and the GPFG.** We start from the non-oil fiscal deficit and the path of GG gross debt, which are given by the April 2018 WEO figures.<sup>1</sup> From year to year, gross debt increases in nominal terms to keep it broadly constant relative to mainland GDP. We assume that the entire net increase in nominal GG gross debt is met by new issuance, i.e. valuation effects are zero. Then we first specify how much financial assets the GG accumulates outside of the GPFG; given that accumulation was positive in past years, we set this at NOK 100 billion for all years until 2023. Taken together, these three variables determine how high withdrawals from the GPFG have to be in each year to fully finance the government. In our projections, these withdrawals remain in the neighborhood of its 2017 value; this is intuitive given that non-oil fiscal deficits are projected to remain stable. For the GPFG, we further assume that it would achieve a 5 percent nominal annual return. Together with the oil revenues that it receives, this ensures that its size would remain stable close to 300 percent of mainland GDP. Finally, transactions in GG nonfinancial assets are projected using the data on GG investment from the April 2018 WEO.

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<sup>1</sup> Regarding GG liabilities note that the figure reported in this paper is somewhat higher than the gross debt figure commonly reported, because the former also includes accounts payable.

- **Public corporations.** We assume that the operating balance of public corporations (excluding the central bank) remains at a constant at its 2016 value of 9¼ percent of mainland GDP. Thereof, 4¾ percent of mainland GDP would be invested in non-financial assets—again as in 2016. Transactions in financial assets are set to zero, implying that the remainder is put toward reducing liabilities. The operating balance of the Norges Bank has been close to zero in 2016 and we retain that value in our projections.

4. **To set up the complete PSBS, we also need to project valuation changes of public sector assets and liabilities** (Figure II.1). Setting up a baseline scenario of valuation changes allows us to simulate the impact of shocks through valuation changes, e.g., on equity prices. For the general government, we proxy valuation changes of non-financial assets with the house price index and assume that valuation changes of financial liabilities are zero.<sup>2</sup> Currency and deposits and other accounts receivable are assumed to grow by the short-term interest rate. Debt securities' valuation varies inversely with the long-term bond yield. Valuation gains and losses of equities and financial derivatives are projected using the same 5 percent nominal return assumed for the GPF. We project public corporations' balance sheets along the same lines.

5. **We also project the present value of existing pension liabilities.** To do so, we repeat the procedure described in paragraph 11 of Annex I for each year from 2018 to 2023. Thereby, we again to split the flow of all future pension expenditure into that relating to existing and future work. Finally, we again compute the present value of the future expenditure stream related to existing pensions.

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<sup>2</sup> We project house price inflation to be equal to CPI inflation plus 2/3 of real mainland GDP growth. Historically, valuation changes of general government liabilities have been small.

**Table II.1. Key Variables under Baseline Assumptions**

	2018	2019	2020	2021	2022	2023
	(Percentage change, unless otherwise indicated)					
Real mainland GDP growth	2.5	2.4	2.3	2.2	2.2	2.2
Nominal mainland GDP growth	5.3	6.6	5.7	5.2	4.8	4.6
CPI inflation	1.9	2.0	2.0	2.0	2.0	2.0
Employment growth	0.8	1.1	1.1	1.1	1.1	1.1
Unemployment rate (Percent)	3.9	3.7	3.7	3.7	3.7	3.7
	(Percent of mainland GDP)					
Non-oil fiscal balance	-7.6	-7.6	-7.6	-7.6	-7.6	-7.6
Non-oil primary balance	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8
Non-oil revenues	49.1	49.1	49.1	49.1	49.1	49.1
Expenditure	57.9	57.9	57.9	57.9	57.9	57.9
Primary expenditure	56.7	56.7	56.7	56.7	56.7	56.7
Pension expenditure	10.5	10.6	10.7	10.8	10.9	11.0
Existing pensions	10.4	10.3	10.2	10.2	10.1	10.1
Future pensions	0.1	0.3	0.5	0.6	0.8	0.9
Health care expenditure	6.7	6.7	6.6	6.7	6.8	6.9
Long-term care expenditure	4.1	4.1	4.2	4.2	4.2	4.2
Other primary expenditure	34.2	34.1	33.9	33.8	33.6	33.5
Interest expenditure	1.2	1.2	1.2	1.2	1.2	1.2
<i>Memorandum items:</i>						
Nominal mainland GDP (NOK billions)	2,953	3,147	3,328	3,500	3,667	3,834

Source: Fund staff projections.

### Long-term projections (beyond 2023)

6. **We use a growth accounting approach based on productivity and labor force projections to extend macro projections through 2100.** Long-run potential growth for mainland Norway is estimated around 1¾ percent, in line with the April 2018 WEO estimates. Labor productivity would be the its main driver, but population growth would also make a smaller positive contribution (Figure II.1).

- **Labor productivity.** We assume that labor productivity growth would stabilize around 1¼ percent over the long term. This is broadly in line with current readings as well as April 2018 WEO forecasts for the medium term, but about ¼ to ½ a percentage point lower than Norway’s historical average of the past two decades.

- **Labor force.** The Norwegian Ministry of Finance kindly provided a custom set of estimates for the labor force through 2100.<sup>3</sup> Starting from population projections, it derives the labor force in any future year by taking into account that participation rates vary across gender and age groups. Furthermore, a version is provided that takes migration background into account and we use that version for our baseline projection. It makes for a more conservative projection, as immigrants' participation rates tend to be lower.

Combining these two inputs provides us with the projection of real mainland GDP. Adding Norges Bank's inflation target of 2 percent gives us nominal mainland GDP.

7. **For the fiscal variables, we assume constant ratios relative to mainland GDP but adjust for increasing age-related expenditure.** For non-oil fiscal revenues, we assume that they remain at the projected 2023 level of 49.1 percent of mainland GDP.<sup>4</sup> We decompose primary expenditures into pension, health, long-term care, and other primary expenditures. This allows us to account for Norway becoming subject to adverse aging trends from now on, in contrast to the last two decades when the share elderly persons in the population actually declined, mirroring low birth rates between the two world wars. For other primary expenditures, we assume that they would remain constant at their 2023 level of 33.5 percent of mainland GDP. For pension, health, and long-term care expenditures as a share of mainland GDP, we use projections provided by the Norwegian Ministry of Finance out to 2100. Based on these long-run projections, we calculate present values of future revenues and expenditures using a 5 percent nominal discount rate.<sup>5</sup> The present values that we compute cover the period from 2018 to infinity; we include revenues and expenditures after 2100 by assuming that they would stay constant at their 2100 values in real terms and then we apply the formula for computing the present value of a perpetuity.

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<sup>3</sup> We thank Siri Wingaard and the Norwegian Ministry of Finance for providing these data.

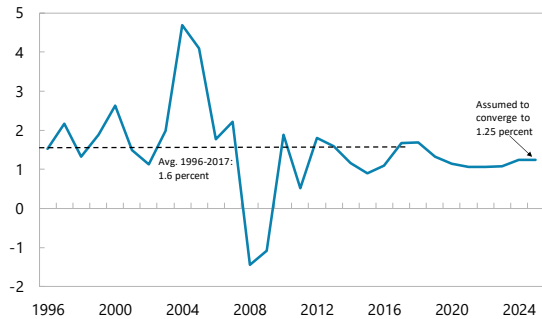
<sup>4</sup> In light of aging, this assumption could be somewhat optimistic, although we maintain it for simplicity. The reason is that pension incomes are subject to reduced tax rates compared to other labor income. The foregone revenue due to this lower tax has been around 0.8 of a percent of mainland GDP in the recent past and would grow in line with aging over the long term in absence of offsetting policy action.

<sup>5</sup> Again, this is in line Norges Bank's 2 percent annual inflation over the long term and a 3 percent real discount factor. Setting this discount factor in line with the nominal expected yield of the GPFG also ensures that results remain easy to interpret, as no wedges between different balance sheet components can result from different discount factors.

### Figure II.1. Long-Term Projections (Under Baseline Assumptions)

Labor productivity growth is assumed to stabilize at 1¼ percent.

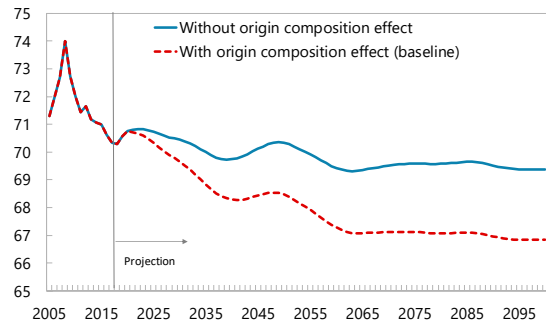
**Mainland Norway Labor Productivity Growth**  
(Percent)



Sources: Statistics Norway and Fund Staff projections.  
Note: Labor Productivity is computed as real mainland GDP per employed person.

Participation rates are projected to fall by 3–4 percentage points by the 2060s.

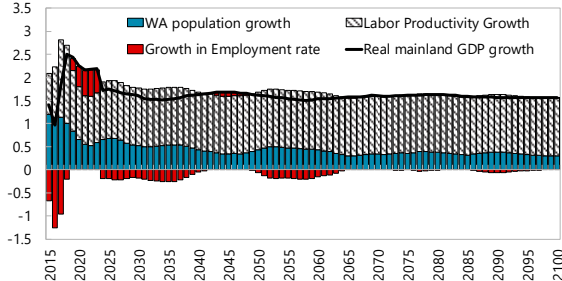
**Labor Force Participation Rate**  
(Percent of the 15-74 year-old population)



Source: Norwegian authorities.  
Note: The baseline series accounts for lower participation rates among immigrants.

Nonetheless, population growth would modestly contribute to 1½–1¾ percent potential growth.

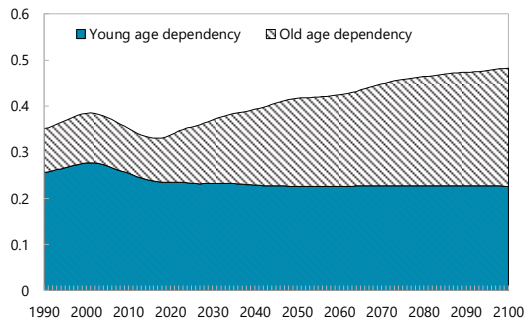
**Long-run real mainland GDP growth assumptions**  
(Percent)



Sources: Statistics Norway and Fund Staff projections.

Aging trends will shift from positive to adverse from this point onwards.

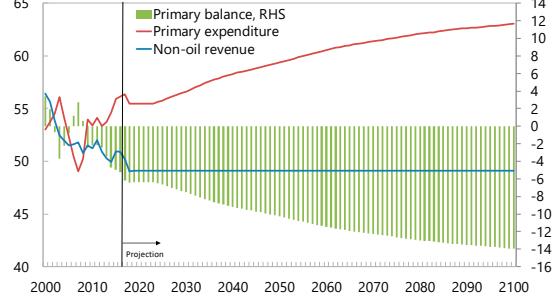
**Dependency Ratio**  
(Persons aged 0-14 and 75+ per person aged 15-74)



Sources: Statistics Norway and Fund Staff calculations.

Assuming no policy changes, this would expand the fiscal deficit considerably.

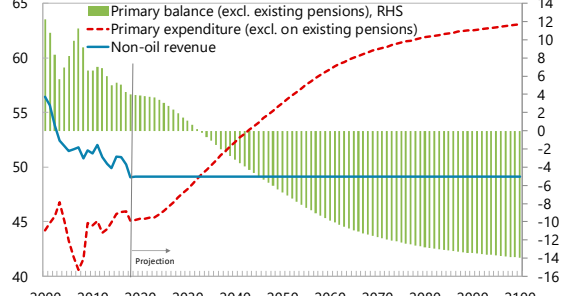
**Main fiscal variables**  
(Percent of mainland GDP)



Sources: Norwegian authorities and Fund Staff projections.

The static PSBS already covers future expenditure on existing pensions. To avoid double counting, they are therefore excluded from the PSBS's intertemporal component.

**Main fiscal variables, excl. existing pension expenditure**  
(Percent of mainland GDP)



Sources: Norwegian authorities and Fund Staff projections.



## ANNEX III. CALIBRATION OF THE STRESS TEST

1. **We calibrate a stress scenario, somewhat more severe than the global financial crisis; the shock is assumed to hit in 2019.** In designing the stress scenario, we design a path for macro variables that mirrors the average of the last two major downturns experienced by Norway: the late 1980s Nordic Banking crisis and the Global Financial Crisis (GFC) of 2008–09. In line with this, we assume that real mainland GDP falls by 1.3 percent in 2019 and only grows by 0.6 percent in 2020, compared to growth above 2 percent under the baseline (Table III.1). Relative to a medium-term potential growth rate of 2.2 percent, this stress scenario implies lost growth of 5½ percent. In terms of the labor market response, we assume that unemployment will peak at 5.6 percent in 2021, from the current level of slightly below 4 percent. This would be about half the increase observed after the Nordic banking crisis, but considerably less than during the GFC. We also assume a permanent fall in oil prices of 15 percent relative to the baseline.

Table III.1. Key Variables Under Stress Assumptions

	2018	2019	2020	2021	2022	2023
	(Percentage change, unless otherwise indicated)					
Real mainland GDP growth	2.5	-1.3	0.6	2.1	3.5	3.3
Nominal mainland GDP growth	5.3	1.2	3.1	5.2	6.5	6.0
CPI inflation	1.9	0.5	1.1	2.1	2.4	2.3
Employment growth	0.8	0.2	-0.1	1.1	2.1	1.6
Unemployment rate (Percent)	3.9	4.5	5.6	5.6	4.7	4.2
	(Percent of mainland GDP)					
Non-oil fiscal balance	-7.6	-9.3	-9.9	-9.8	-9.2	-8.6
Non-oil primary balance	-8.8	-10.5	-11.2	-11.0	-10.4	-9.9
Non-oil revenues	49.1	50.0	50.6	50.6	50.2	49.9
Expenditure	57.9	60.5	61.8	61.6	60.6	59.7
Primary expenditure	56.7	59.3	60.6	60.4	59.3	58.5
Pension expenditure	10.5	11.2	11.6	11.6	11.5	11.5
Existing pensions	10.4	10.9	11.0	11.0	10.7	10.5
Future pensions	0.1	0.3	0.6	0.6	0.8	1.0
Health care expenditure	6.7	7.0	7.2	7.3	7.2	7.2
Long-term care expenditure	4.1	4.3	4.5	4.5	4.4	4.4
Other primary expenditure	34.2	35.5	36.0	35.7	34.9	34.2
Interest expenditure	1.2	1.3	1.3	1.3	1.3	1.2
<i>Memorandum items:</i>						
Nominal mainland GDP (NOK billions)	2,953	2,989	3,082	3,242	3,454	3,663

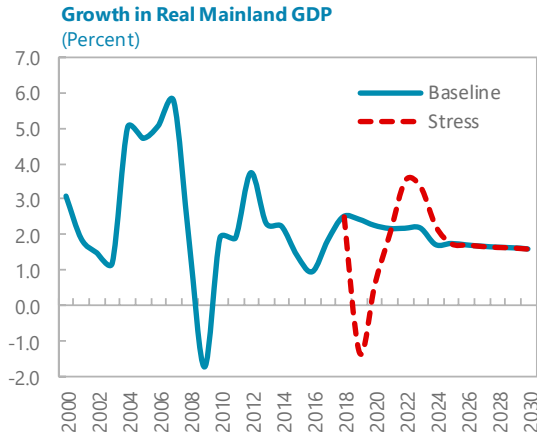
Source: Fund staff estimates.

Notes: The table displays assumptions under the scenario without post-crisis fiscal adjustment. Those for the scenario with post-crisis fiscal adjustment hardly differ before 2023, as adjustment is assumed to be undertaken from 2024 forward. Table II.1 in Annex II provides the analog baseline assumptions.

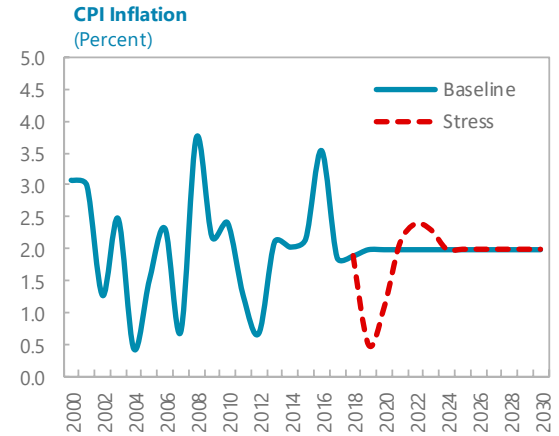
2. **With firms retaining some labor, output falls more than employment in the stress scenario; this results in an increase in the fiscal revenue ratio.** In comparison to the baseline projection, both growth and inflation dip, but then rebound above baseline as the economy recovers and employment and unemployment converge toward the baseline by the mid-2020s (Figure III.1). Due to labor retention, the drops in employment and in labor compensation are more muted than that in mainland GDP. This has important implications for fiscal revenues; while falling in nominal krone terms, they are projected to rise in proportion to mainland GDP in the stress scenario.
3. **Asset prices are also adversely affected in the stress scenario** (Figure III.2). Together with our baseline for changes in asset prices, simulating a synchronous asset price shock allows us to also evaluate the impact of valuation changes—which would be likely to occur during a relatively severe crisis—on the public sector balance sheet. We assume that house prices fall by about 20 percent relative to the baseline in 2019 followed by a gradual recovery. This is broadly in line with experiences of countries suffering housing price collapses after the global financial crisis. We assume for equity prices a drop of 25 percent relative to the baseline in 2019 and a somewhat quicker recovery compared to that of housing prices.
4. **In setting the equity price drop for the stress scenario, we take into account the experience during the GFC as well as the Shiller 10-year trailing price-earnings (PE) ratio.** During the GFC, global equities (as measured by the MSCI All-Country World Equity Index) experienced a larger than 50 percent peak-to-trough decline. The decline between mid-2007 and mid-2010, which comprises the initial post-crisis rebound, was 25 percent. The Shiller 10-year trailing price-earnings (PE) ratio is a much-watched measure of cyclically-adjusted equity valuations and has been shown to be negatively correlated with future asset price returns (Shiller, 2016). For U.S. stocks in the S&P500 index, this measure stands currently at about double of its long-term average. Taken together, this suggests that a 25 percent equity price correction is not unfathomable. With regards to the Shiller measure, such a correction still leaves the PE ratio well above its long term historical average, which would likely be justified by the low interest rate environment.
5. **The fiscal balance deteriorates under the stress scenario, mainly driven by higher expenditures.** Figure III.3 summarizes how fiscal flows are affected under the stress scenario. While falling in absolute terms, general government revenues initially increase relative to mainland GDP, because labor compensation drops less than mainland GDP as firms retain some labor. Revenues will, however, revert back to the baseline as the economy recovers. Expenditures increase during the crisis on account of automatic stabilizers, such as higher expenditures on unemployment benefits. Expenditures also remain above the baseline in the long term, because (i) mainland GDP in levels suffers a permanent loss as is typical as a result of crises (e.g., as human capital of the unemployed depreciates) and (ii) some expenditures' growth is independent of GDP (e.g., health care expenditures, which are mainly driven by aging, remain the same in nominal terms). Therefore, absent additional post-crisis fiscal consolidation efforts, fiscal deficits would remain elevated compared to the baseline.

### Figure III.1. Calibrating the Stress Test: Macroeconomic Variables

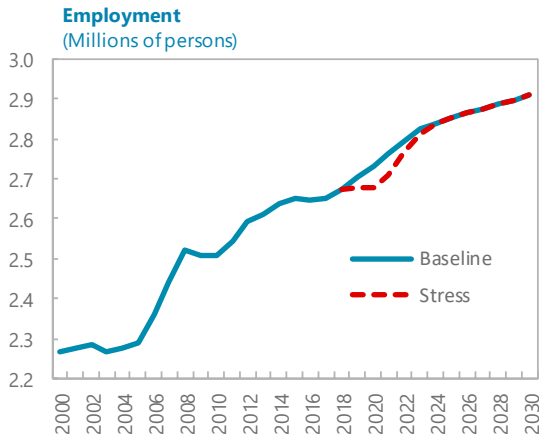
Real mainland GDP is assumed to fall by 1.3 percent in 2019 and hardly grow in 2020, before surpassing the baseline as labor is reabsorbed.



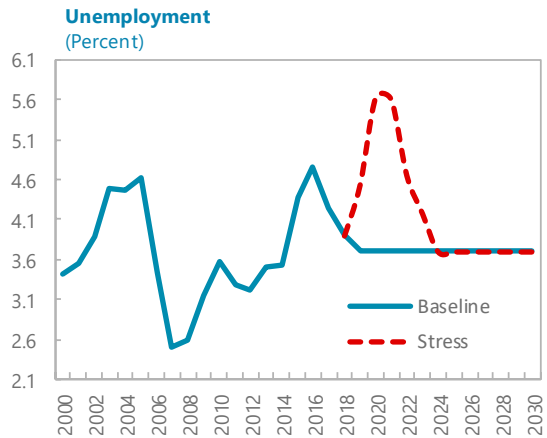
Inflation displays a similar path.



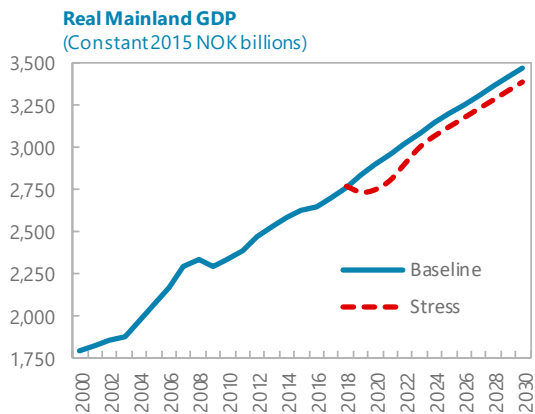
Employment is assumed to stagnate in 2019 and 2020, compared to growth about 1 percent in the baseline.



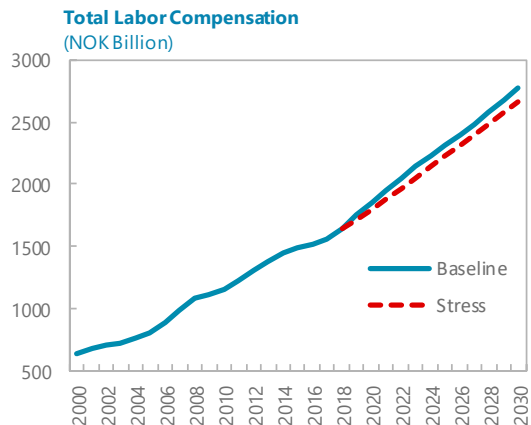
Unemployment peaks at 5.6 percent in 2021 before gradually returning back to the baseline.



After the crisis, real mainland GDP converges back toward the baseline, but remains somewhat lower.



The same is true for total labor compensation.

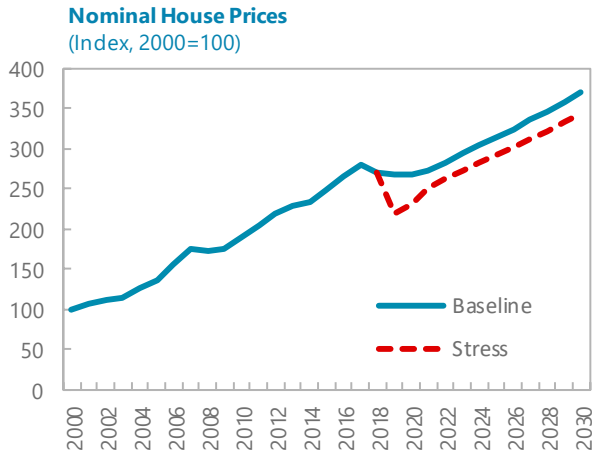


Sources: Statistics Norway and Fund Staff estimates.

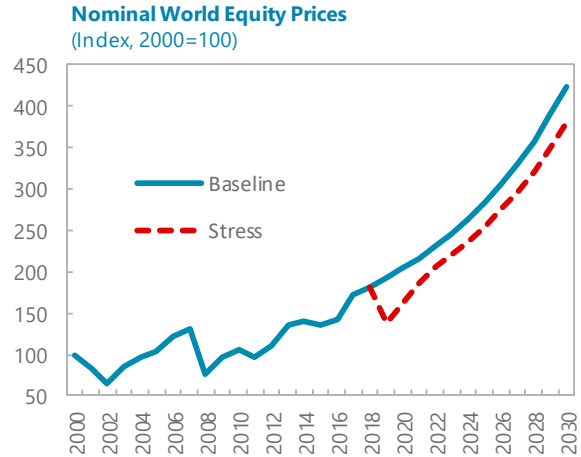
### Figure III.2. Calibrating the Stress Test: Valuation Changes and Contingent Liability Shock

House prices are assumed to drop in 2019 by about 20 percent in the stress scenario relative to the baseline.

Equity prices are assumed to fall by 25 percent in 2019 in the stress scenario.



Sources: Statistics Norway and Fund Staff estimates.

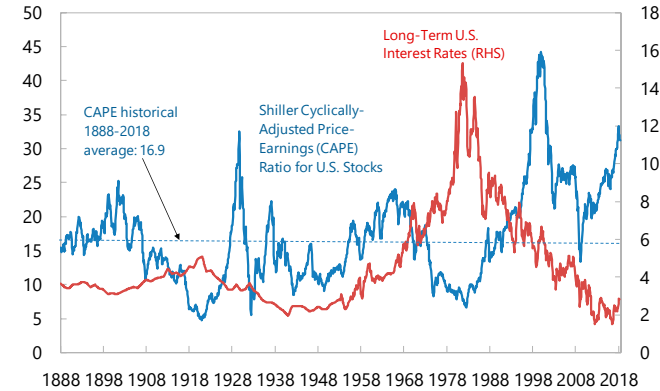


Sources: Statistics Norway and Fund Staff estimates.

Such a correction in equity valuations would still leave Shiller's cyclically-adjusted price earnings measure, which currently exceeds 30, considerably above its long-run historical average. Somewhat higher valuations than the historical average would seem justified by the low interest rate environment.

#### U.S. Stock Market Valuations and Long-term Interest Rates

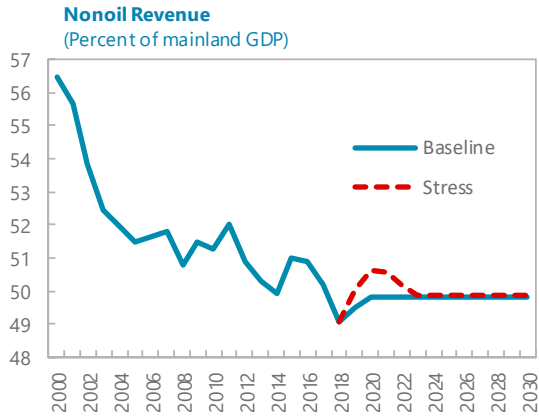
(Ratio and Percent)



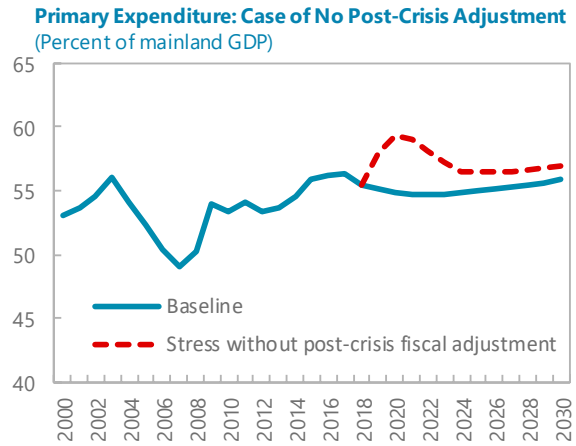
Sources: Shiller (2016).

**Figure III.3. Fiscal Variables Under the Baseline and Stress Scenarios**

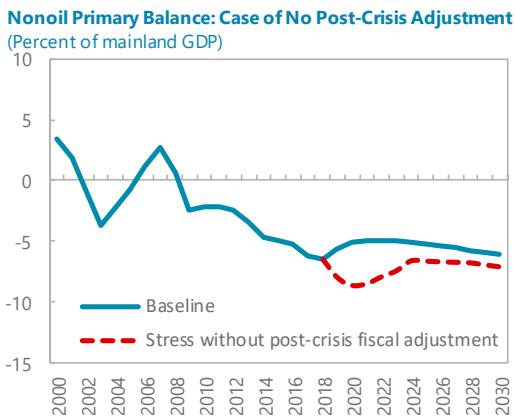
The non-oil revenue ratio increases, despite revenues falling in krone terms, because income taxes fall by less than output due to labor retention.



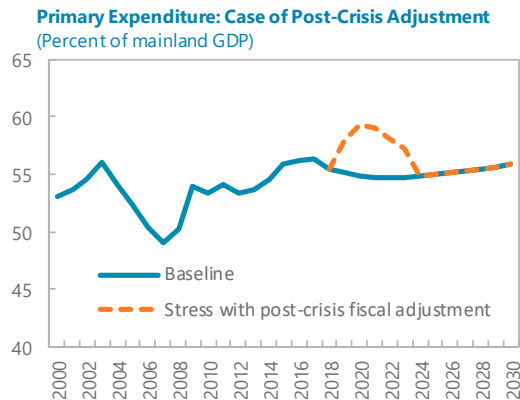
Without any post-crisis fiscal effort, expenditures remain above the baseline path by 1-1¼ percent of mainland GDP.



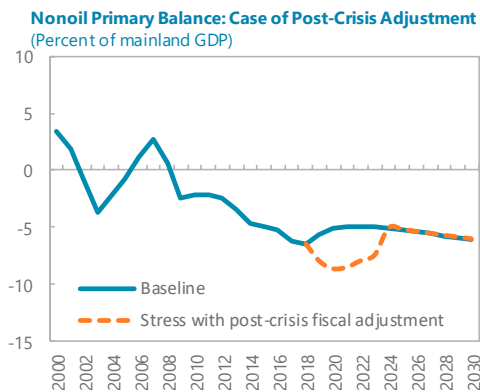
This negatively affects the intertemporal component, so that IFNW would be about 95 percent of mainland GDP lower.



If a post-crisis fiscal effort is made to bring expenditures ...



... and thereby the fiscal deficit back to baseline, IFNW would only be about 25 percent of mainland GDP lower.



Sources: Statistics Norway and Fund Staff estimates.

**Table IV.1. Norway's Historic Public Sector Balance Sheets 1995–2017**  
(Percent of mainland GDP)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
<b>A (=B+D-F)</b>	<b>Static Net Worth</b>	<b>113.0</b>	<b>127.6</b>	<b>119.9</b>	<b>55.8</b>	<b>66.9</b>	<b>147.4</b>	<b>154.4</b>	<b>95.3</b>	<b>102.0</b>	<b>177.3</b>	<b>319.0</b>	<b>373.6</b>	<b>399.7</b>	<b>448.8</b>	<b>458.0</b>	<b>440.2</b>	<b>476.2</b>	<b>471.0</b>	<b>479.8</b>	<b>483.7</b>	<b>382.0</b>	<b>340.9</b>	<b>341.7</b>
<b>B</b>	<b>General Government</b>	<b>351.4</b>	<b>366.6</b>	<b>352.4</b>	<b>284.2</b>	<b>293.5</b>	<b>369.2</b>	<b>373.3</b>	<b>326.9</b>	<b>331.1</b>	<b>400.2</b>	<b>530.4</b>	<b>567.5</b>	<b>586.4</b>	<b>648.4</b>	<b>660.7</b>	<b>643.6</b>	<b>684.1</b>	<b>676.3</b>	<b>682.3</b>	<b>683.4</b>	<b>585.9</b>	<b>545.3</b>	<b>545.4</b>
	Assets	399.7	411.4	392.6	320.3	331.4	415.8	418.8	379.5	393.6	469.5	598.1	650.5	663.3	728.9	726.3	710.9	733.8	728.4	734.2	732.4	639.6	602.7	603.0
	Nonfinancial	344.5	352.2	329.7	257.9	264.0	321.0	309.1	265.1	258.9	316.6	426.0	449.8	465.0	524.0	519.6	488.6	522.5	502.6	467.1	426.3	296.8	264.5	237.1
	Oil and gas (in ground)	269.5	277.5	256.3	185.1	190.3	247.6	236.4	192.6	185.4	243.0	353.0	377.1	393.0	450.1	442.4	411.5	443.6	424.0	388.7	345.7	212.7	178.5	149.1
	Other	75.0	74.8	73.4	72.8	73.7	73.5	72.7	72.5	73.5	73.6	73.1	72.7	72.0	73.9	77.2	77.1	78.9	78.6	78.4	80.7	84.2	86.0	88.1
	Financial	55.3	59.2	62.9	62.3	67.4	94.7	109.8	114.3	134.7	153.0	172.1	200.7	198.4	204.9	206.7	222.3	211.3	225.8	267.1	306.1	342.8	338.2	365.8
	GPFG	0.0	5.3	12.0	16.8	20.7	33.8	50.6	48.4	64.6	72.2	92.4	107.3	110.2	116.9	134.3	148.1	153.2	166.0	207.9	253.2	285.2	276.4	302.7
	Other 1/ 2/	55.3	53.9	50.9	45.5	46.7	61.0	59.1	66.0	70.1	80.8	79.7	93.3	88.1	88.0	72.4	74.2	58.1	59.8	59.2	52.9	57.6	61.8	63.1
	Liabilities 3/	48.4	44.8	40.2	36.1	37.9	46.6	45.5	52.6	62.5	69.3	67.7	82.9	76.9	80.5	65.6	67.3	49.8	52.1	51.9	49.0	53.8	57.4	57.5
<b>D</b>	<b>Public Corporations and Central Bank</b>	<b>33.9</b>	<b>33.6</b>	<b>34.8</b>	<b>34.1</b>	<b>36.7</b>	<b>39.4</b>	<b>41.7</b>	<b>33.4</b>	<b>40.0</b>	<b>40.8</b>	<b>47.2</b>	<b>54.5</b>	<b>50.8</b>	<b>35.5</b>	<b>42.1</b>	<b>40.5</b>	<b>38.2</b>	<b>39.8</b>	<b>42.5</b>	<b>41.9</b>	<b>43.6</b>	<b>47.8</b>	
	Assets	133.5	134.5	132.9	130.4	134.1	123.6	115.8	118.5	118.1	131.4	130.0	128.5	135.4	151.7	142.0	152.2	150.7	145.7	146.6	150.6	144.1	137.0	150.7
	Nonfinancial	54.5	54.5	54.5	54.4	54.4	47.7	45.5	46.1	45.4	46.1	46.5	44.4	44.3	43.6	43.9	43.3	44.0	43.1	43.5	44.7	42.1	40.8	44.9
	Financial 3/	79.0	80.1	78.4	76.0	79.7	75.9	70.3	72.5	72.7	85.3	83.4	84.1	91.1	108.1	98.1	109.0	106.7	102.6	103.1	105.9	102.1	96.2	105.8
	Liabilities 2/	99.6	100.9	98.1	96.4	97.4	84.2	74.0	85.1	78.1	90.6	82.7	74.0	84.6	116.2	99.9	111.8	112.1	107.5	106.8	108.1	102.3	93.4	102.9
<b>F</b>	<b>Existing Pension Liabilities</b>	<b>272.2</b>	<b>272.7</b>	<b>267.4</b>	<b>262.5</b>	<b>263.4</b>	<b>261.2</b>	<b>260.7</b>	<b>265.0</b>	<b>269.1</b>	<b>263.7</b>	<b>258.6</b>	<b>248.5</b>	<b>237.5</b>	<b>235.1</b>	<b>244.8</b>	<b>243.9</b>	<b>246.5</b>	<b>243.4</b>	<b>242.3</b>	<b>242.3</b>	<b>245.7</b>	<b>248.0</b>	<b>251.5</b>
<b>G (=H-I)</b>	<b>Intertemporal Component 4/</b>	<b>-332.2</b>	<b>-335.6</b>	<b>-333.1</b>	<b>-328.6</b>	<b>-333.3</b>	<b>-340.8</b>	<b>-349.0</b>	<b>-361.3</b>	<b>-370.9</b>	<b>-369.0</b>	<b>-368.6</b>	<b>-362.8</b>	<b>-357.1</b>	<b>-362.1</b>	<b>-383.3</b>	<b>-387.7</b>	<b>-398.4</b>	<b>-400.5</b>	<b>-405.1</b>	<b>-411.1</b>	<b>-423.7</b>	<b>-434.5</b>	<b>-446.6</b>
<b>H</b>	<b>PV of Future Revenues</b>	<b>4,947.4</b>	<b>4,863.3</b>	<b>4,679.8</b>	<b>4,514.3</b>	<b>4,452.5</b>	<b>4,333.9</b>	<b>4,246.0</b>	<b>4,240.8</b>	<b>4,234.5</b>	<b>4,081.7</b>	<b>3,935.2</b>	<b>3,716.1</b>	<b>3,491.4</b>	<b>3,399.3</b>	<b>3,484.5</b>	<b>3,413.1</b>	<b>3,394.5</b>	<b>3,303.0</b>	<b>3,241.1</b>	<b>3,199.2</b>	<b>3,205.7</b>	<b>3,197.6</b>	<b>3,205.5</b>
<b>I</b>	<b>PV of Future Primary Expenditures</b>	<b>5,279.6</b>	<b>5,198.9</b>	<b>5,012.9</b>	<b>4,842.9</b>	<b>4,785.8</b>	<b>4,674.7</b>	<b>4,595.1</b>	<b>4,602.1</b>	<b>4,605.4</b>	<b>4,450.7</b>	<b>4,303.8</b>	<b>4,078.9</b>	<b>3,848.5</b>	<b>3,761.4</b>	<b>3,867.8</b>	<b>3,800.8</b>	<b>3,792.9</b>	<b>3,703.5</b>	<b>3,646.3</b>	<b>3,610.3</b>	<b>3,629.4</b>	<b>3,632.1</b>	<b>3,652.1</b>
	Expenditure on future pensions	892.7	875.8	841.2	809.7	797.1	775.7	759.7	758.0	755.8	727.5	700.6	661.2	621.3	605.0	620.0	607.1	603.7	587.3	576.2	568.5	569.4	567.8	568.6
	Health and long-term care expenditure	1,284.5	1,266.6	1,222.7	1,182.3	1,169.2	1,142.8	1,124.1	1,126.2	1,127.4	1,089.8	1,054.0	999.0	942.5	921.5	948.2	932.4	931.2	909.7	896.0	887.6	892.9	894.2	899.6
	Health care	784.6	773.7	746.8	722.1	714.1	698.0	686.5	687.8	688.5	665.5	643.5	609.9	575.4	562.5	578.8	569.2	568.4	555.2	546.8	541.6	544.7	545.3	548.5
	Long-term care	499.9	492.9	475.9	460.2	455.1	444.9	437.6	438.5	439.0	424.4	410.4	389.0	367.1	358.9	369.4	363.3	362.8	354.5	349.2	346.0	348.2	348.8	351.1
	Other primary expenditure	3,349.0	3,290.5	3,165.8	3,052.0	3,009.5	2,933.4	2,876.9	2,875.0	2,870.5	2,767.8	2,670.7	2,525.4	2,377.3	2,317.4	2,376.1	2,328.0	2,316.1	2,254.8	2,213.0	2,184.1	2,188.3	2,182.4	2,186.9
<b>L (=A+G-C-E)</b>	<b>Intertemporal Financial Net Worth, IFNW 5/</b>	<b>-348.7</b>	<b>-337.3</b>	<b>-341.1</b>	<b>-400.1</b>	<b>-394.5</b>	<b>-314.6</b>	<b>-312.8</b>	<b>-384.6</b>	<b>-387.8</b>	<b>-311.3</b>	<b>-169.2</b>	<b>-106.3</b>	<b>-73.7</b>	<b>-30.8</b>	<b>-46.4</b>	<b>-67.8</b>	<b>-45.2</b>	<b>-51.2</b>	<b>-47.2</b>	<b>-52.8</b>	<b>-168.0</b>	<b>-220.4</b>	<b>-237.9</b>
	<i>Memorandum item:</i>																							
	Nominal mainland GDP (NOK billions)	828.6	876.4	946.6	1,020.1	1,074.5	1,144.8	1,211.8	1,258.7	1,308.2	1,407.9	1,514.4	1,661.7	1,831.0	1,946.7	1,966.1	2,077.6	2,161.6	2,298.4	2,423.2	2,539.6	2,621.0	2,717.3	2,803.8

Source: Authors' calculations and estimations based on various data sources (see Annex I).

1/ The data displayed adjust source data for equity investments in public corporations (to avoid double counting with the public corporations data) and for oil production licenses held by the state as part of State Direct Financial Interest (whose value is counted indirectly in the PV of remaining oil/gas deposits).

2/ Data are consolidated for GG deposits at the Central Bank.

3/ Data are consolidated for the Central Bank holding GG securities which was the case until 2003.

4/ The intertemporal component is the present value of future primary balances, where the underlying primary balance excludes expenditures for existing pension liabilities as well as oil revenues and GPFG yields, which are included in static net worth.

5/ Includes the present value of oil and gas in ground, because it can be quite easily monetized and—unlike sell-off of many other public sector nonfinancial assets—doing so would not affect non-oil revenues.

**Table IV.2. Norway's Historic Public Sector Balance Sheets 1995–2017**  
(NOK billions)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<b>A (=B+D-F)</b> Static Net Worth	936	1,118	1,135	570	719	1,687	1,870	1,200	1,334	2,496	4,831	6,208	7,319	8,736	9,004	9,145	10,293	10,826	11,627	12,283	10,013	9,263	9,582
<b>B</b> General Government	2,912	3,213	3,336	2,899	3,154	4,227	4,524	4,115	4,331	5,635	8,032	9,431	10,738	12,622	12,990	13,372	14,787	15,544	16,534	17,357	15,356	14,817	15,293
Assets	3,312	3,606	3,716	3,267	3,561	4,760	5,075	4,776	5,149	6,610	9,057	10,809	12,146	14,189	14,280	14,770	15,863	16,743	17,792	18,601	16,765	16,377	16,906
Nonfinancial	2,855	3,087	3,121	2,631	2,837	3,675	3,745	3,337	3,386	4,457	6,451	7,474	8,514	10,201	10,216	10,150	11,294	11,553	11,320	10,827	7,780	7,188	6,649
Oil and gas (in ground)	2,233	2,432	2,426	1,888	2,045	2,834	2,864	2,424	2,425	3,421	5,345	6,266	7,195	8,762	8,699	8,550	9,589	9,746	9,419	8,778	5,574	4,851	4,180
Other	621	655	695	743	792	841	881	913	961	1,036	1,106	1,208	1,318	1,439	1,517	1,601	1,706	1,806	1,901	2,049	2,206	2,337	2,470
Financial	458	519	595	636	724	1,084	1,330	1,439	1,762	2,153	2,606	3,335	3,632	3,988	4,064	4,619	4,569	5,190	6,473	7,774	8,985	9,189	10,257
GPF	0	46	113	172	222	386	614	609	845	1,016	1,399	1,784	2,019	2,275	2,640	3,077	3,312	3,816	5,038	6,431	7,475	7,510	8,488
Other 1/ 2/	458	473	482	464	502	698	716	830	917	1,137	1,207	1,551	1,613	1,713	1,424	1,542	1,257	1,374	1,435	1,343	1,510	1,679	1,768
Liabilities 3/	401	393	380	368	407	533	552	662	818	975	1,025	1,378	1,408	1,567	1,290	1,398	1,076	1,198	1,259	1,244	1,409	1,560	1,613
<b>D</b> Public Corporations and Central Bank	281	295	330	348	395	451	506	420	523	575	715	906	931	691	828	840	834	877	964	1,080	1,097	1,185	1,341
Assets	1,106	1,179	1,258	1,331	1,441	1,415	1,403	1,492	1,544	1,850	1,968	2,136	2,479	2,954	2,792	3,163	3,257	3,349	3,553	3,824	3,778	3,722	4,226
Nonfinancial	452	478	516	555	585	546	551	580	594	649	705	738	812	849	863	899	951	991	1,053	1,134	1,103	1,109	1,259
Financial 3/	654	702	742	775	856	868	852	912	951	1,201	1,263	1,397	1,667	2,105	1,929	2,264	2,306	2,358	2,499	2,690	2,675	2,613	2,967
Liabilities 2/	826	884	928	983	1,046	964	897	1,072	1,021	1,275	1,253	1,229	1,548	2,263	1,965	2,322	2,423	2,472	2,589	2,745	2,681	2,537	2,885
<b>F</b> Existing Pension Liabilities	2,256	2,390	2,531	2,677	2,830	2,990	3,159	3,336	3,520	3,713	3,916	4,129	4,349	4,577	4,814	5,068	5,329	5,595	5,871	6,153	6,440	6,739	7,052
<b>G (=H-I)</b> Intertemporal Component 4/	-2,753	-2,941	-3,153	-3,352	-3,581	-3,902	-4,230	-4,548	-4,852	-5,195	-5,582	-6,029	-6,539	-7,049	-7,536	-8,054	-8,612	-9,206	-9,818	-10,441	-11,106	-11,805	-12,522
H PV of Future Revenues	40,996	42,623	44,297	46,048	47,842	49,616	51,453	53,379	55,394	57,465	59,593	61,751	63,927	66,174	68,509	70,911	73,375	75,918	78,540	81,246	84,021	86,889	89,878
I PV of Future Primary Expenditures	43,749	45,564	47,449	49,400	51,422	53,518	55,682	57,927	60,246	62,661	65,176	67,780	70,467	73,222	76,045	78,965	81,987	85,124	88,358	91,687	95,128	98,695	102,400
Expenditure on future pensions	7,397	7,675	7,963	8,259	8,565	8,880	9,206	9,541	9,886	10,242	10,609	10,987	11,376	11,777	12,189	12,614	13,051	13,500	13,962	14,437	14,925	15,428	15,943
Health and long-term care expenditure	10,644	11,101	11,574	12,060	12,563	13,083	13,622	14,176	14,748	15,344	15,961	16,600	17,258	17,938	18,642	19,372	20,128	20,908	21,712	22,542	23,403	24,297	25,223
Health care	6,502	6,781	7,069	7,366	7,673	7,990	8,319	8,657	9,006	9,369	9,746	10,135	10,536	10,951	11,380	11,825	12,286	12,761	13,251	13,755	14,277	14,818	15,379
Long-term care	4,142	4,320	4,504	4,694	4,890	5,093	5,303	5,519	5,742	5,975	6,215	6,465	6,722	6,987	7,262	7,547	7,842	8,147	8,461	8,787	9,126	9,479	9,845
Other primary expenditure	27,751	28,838	29,966	31,132	32,337	33,582	34,861	36,187	37,551	38,968	40,444	41,965	43,528	45,113	46,717	48,367	50,065	51,825	53,628	55,468	57,355	59,302	61,317
<b>L (=A+G-C-E)</b> Intertemporal Financial Net Worth, IFNW 5/	-2,889	-2,956	-3,229	-4,081	-4,239	-3,602	-3,791	-4,842	-5,073	-4,383	-2,562	-1,767	-1,350	-600	-912	-1,409	-977	-1,178	-1,144	-1,340	-4,403	-5,988	-6,669
<i>Memorandum item:</i>																							
Nominal Mainland GDP (NOK billions)	829	876	947	1,020	1,074	1,145	1,212	1,259	1,308	1,408	1,514	1,662	1,831	1,947	1,966	2,078	2,162	2,298	2,423	2,540	2,621	2,717	2,804

Source: Authors' calculations and estimations based on various data sources (see Annex I).

1/ The data displayed adjust source data for equity investments in public corporations (to avoid double counting with the public corporations data) and for oil production licenses held by the state as part of State Direct Financial Interest (whose value is counted indirectly in the PV of remaining oil/gas deposits).

2/ Data are consolidated for GG deposits at the Central Bank.

3/ Data are consolidated for the Central Bank holding GG securities which was the case until 2003.

4/ The intertemporal component is the present value of future primary balances, where the underlying primary balance excludes expenditures for existing pension liabilities as well as oil revenues and GPF yields, which are included in static net worth.

5/ Includes the present value of oil and gas in ground, because it can be quite easily monetized and—unlike sell-off of many other public sector nonfinancial assets—doing so would not affect non-oil revenues.