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NORWAY

SELECTED ISSUES

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NORWAY

SELECTED ISSUES

July 30, 2015

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CONTENTS

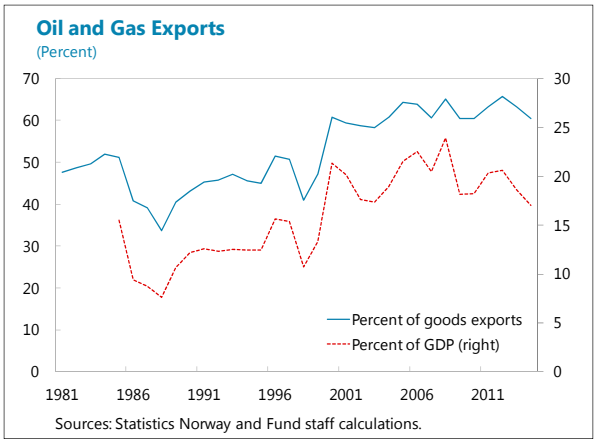
NORWAY'S ECONOMY WITH A MATURING OIL AND GAS INDUSTRY[1]

Norway's half century of good fortune from its oil and gas wealth may have peaked. Oil and gas production will continue for many decades on current projections, but output and investment have flattened out, and the spillovers from the offshore oil and gas production to the mainland economy may have turned from positive to negative. Thus far, economic policy has needed to focus on managing the windfall, and Norway's institutions have been a model for other countries. Going forward, the challenges will become more complex. The problems of managing "Dutch disease" are not gone, but they will abate, particularly if the recent drop in oil prices is sustained. However, they will be replaced by the difficulties of managing a transition away from what has been an increasingly oil- and gas-dependent mainland economy.

A. The Direct Contribution of Oil and Gas to the Norwegian Economy

1. The oil and gas industry has provided only modest direct employment in Norway. Employment in oil and gas extraction has only recently risen above 1 percent of total employment, although the high pay levels in the industry have pushed its share of total wages above 1 percent for some time.

2. The balance of payments impact has been much larger than the employment effect. Oil and gas as a share of exports of goods has risen from an average of 45 percent in 1981–90 to 63 percent in 1995–2014 and from 31 to 48 percent as a share of exports of goods and services. As a share of total Norwegian GDP (mainland and offshore), oil and gas exports have risen from a trough of 8 percent in 1988 to a peak of 24 percent in 2008. With the decline in oil prices in the latter part of 2014, this had fallen to 17 percent in 2014 and will likely be as low or lower in 2015. The effect on the international investment position is more speculative prior to the first transfer to the sovereign wealth fund (the Government Pension Fund Global, GPFG) in 1996, but the balance in that Fund had risen to more than 250 percent of mainland GDP by end-2014.



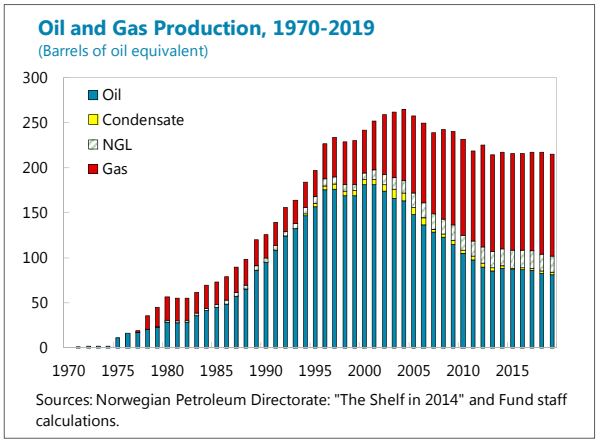
3. Government income from oil and gas has also been much larger than the employment impact. Revenue started off much lower than production and exports because of the tax regime, which generates significant revenue only after investment and other costs have been recovered.

[1] Prepared by Tom Dorsey and Giang Ho.

Also, the revenue streams are multiple and complex. Government revenue from oil and gas generated less than 7 percent of total revenue and less than 4 percent of GDP on average from 1971 to 1995. Petroleum-related revenue was not treated differently from other revenue sources. By the late 1990s, the government began to receive much more substantial revenues from oil and gas. This roughly coincided with the creation of the GPFG and the fiscal rule. By 2000, petroleum-related revenue had risen above 10 percent of GDP and 25 percent of total revenue and has remained above those levels since.

4. The fiscal rule has provided considerable insulation against "Dutch disease." The segregation of the proceeds of oil and gas (including ownership income from the government's two-thirds stake in the Norwegian oil company Statoil), has largely avoided Dutch disease through the exchange rate appreciation or a crowding out of the private sector by government domination of the real economy. However, the insulation against Dutch disease has not been complete. This has been undercut both by the large size and steady growth of the GPFG and by the increasing share of the mainland economy devoted to providing goods and services to the mainland economy. These two channels are considered in turn in the next two sections.

5. However, production has peaked and begun what is projected to be a gradual, multi-decade decline. Roughly half of all of the oil and gas likely to be produced on the Norwegian continental shelf has already been extracted. As a result, the mainland economy needs to diversify away from oil and gas supply and service in the medium- and long-term. However, not all of the challenges from having too much income will persist even as the decline of oil and gas and the attendant investment demand creates a drag on the economy in other ways.



B. The Fiscal Contribution of Oil and Gas to the Mainland Economy: The Fiscal Rule and the Sovereign Wealth Fund

The Fiscal Rule

6. The fiscal rule very effectively insulates Norway's budget from oil price fluctuations except in the long term. There are various official characterizations of the fiscal rule in English, but one recent, concise one explains that:

> *"Fiscal policy is guided by the fiscal rule, stipulating a gradual phasing-in of oil revenues in the Norwegian economy in line with the expected real returns on the Government Pension Fund Global estimated at 4 percent. The fiscal rule permits spending more than the expected return*

on the Fund in a cyclical downturn while the use of oil revenues should lie below the expected return when capacity utilization in the economy is high."[2]

The implication of the fiscal rule is that government spending should disregard direct current oil and gas revenues, and instead transfer 4 percent of GPFG assets to the budget each year as the estimated income from this endowment and that this should be the sole source of non-oil deficit financing.[3]

7. The fiscal rule buffers the economy in three main ways.

- Because government non-oil deficits are a function of not just current oil and gas revenues but of the entire history of oil and gas revenues going back to the GPFG's establishment, it automatically averages oil and gas revenue fluctuations over the history of the GPFG.
- The fiscal rule provides explicitly for counter-cyclical fiscal policy.
- The rule provides for an indefinitely sustainable income source. To the extent that the 4 percent real return assumption is borne out, the income stream should be constant in real terms. If it is higher or lower, the income stream would trend upward or downward in real terms over the very long term, but the GPFG would not be exhausted.

The Government Pension Fund Global

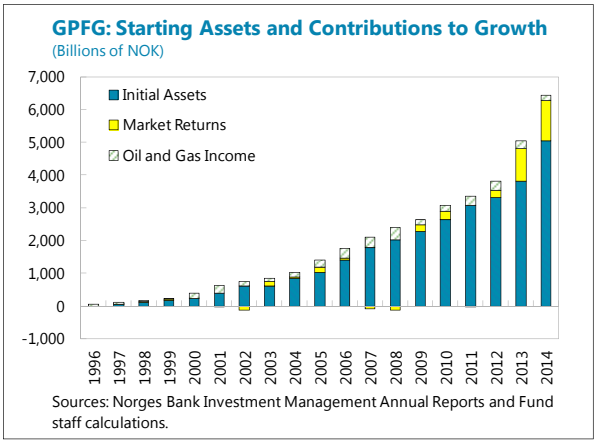
8. The GPFG was created to turn the various streams of government oil revenue into an endowment. The GPFG (originally and more accurately referred to as the Oil Fund) started receiving transfers in 1996. However, it was still small relative to the economy (51 percent of mainland GDP) when the fiscal rule was put in practice after end-2001.

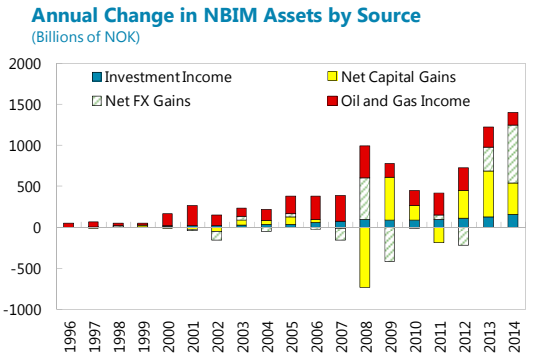
9. The GPFG is managed by the Norges Bank according to relatively strict guidelines set by the government. In its earliest years, investments were concentrated in fixed-income assets, but it quickly evolved into a majority equity-based fund with a widening array of advanced, emerging market, and frontier countries. Currently, the fund guidelines are to invest 65 percent in equities, 30 percent in fixed income, and 5 percent in real estate. The fund operates mostly on a buy-and-hold basis and distributes investments very widely across companies and assets, with the result that its investment strategy, operating costs, and investment outcomes resemble those of a set of very large index funds. As a result of its size, it owns more than one percent of the world's traded equity shares.

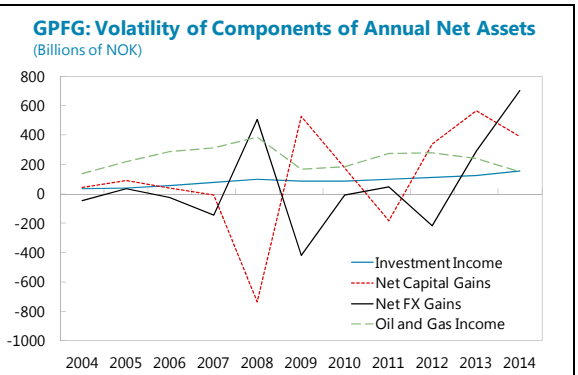
[2] Norwegian Ministry of Finance, 2012.

[3] The measurement of plans versus outcomes in this regard is true to a first approximation, but there are various qualifications to this statement when measuring outcomes due to accounting differences between the government and the GPFG, the need to base budgets on forecasts of revenues, etc.

10. Market returns gain have replaced oil and gas income as both the main sources of annual growth in the GPFG and the main contributors to its volatility. Oil prices and changes in production volumes were originally the main factors driving year-to-year changes in the value of the GPFG. In the last several years, changes in financial market returns have generally had a bigger effect on the value of the GPFG than changes in the oil income. Volatility in investment income (including capital gains) also have a bigger effect on year-to-year changes in the GPFG value than volatility in oil income in recent years.





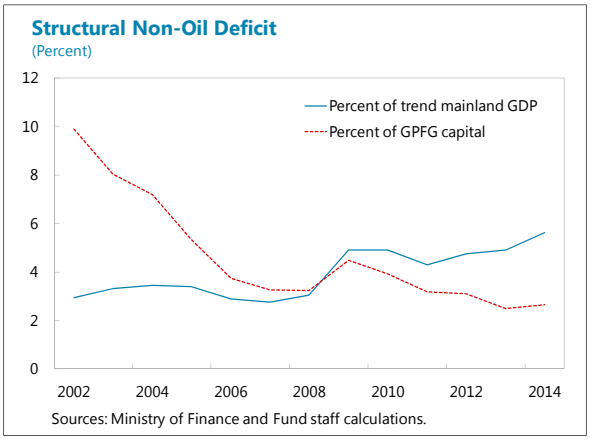


The complications for fiscal policy

11. Higher-than expected production and prices for Norway's oil and gas have implied a steady fiscal stimulus. This complicates the operation of the fiscal rule. At about 250 percent of mainland GDP, a mechanistic application of the fiscal rule would imply a non-oil deficit of 10 percent of mainland GDP. With about half of the oil and gas yet to be produced, the steady state non-oil deficit would be much larger.[4] When the GPFG and the fiscal rule were established, price expectations and expected output were much both much lower than what has been realized and what is currently projected.

[4] The fiscal rule is intended to preserve the real value of the oil and gas income in the GPFG in perpetuity, if the rate-of-return assumptions are borne out. However, a doubling of the cumulative income would not necessarily double the non-oil deficit as population growth and real per capita income growth would also raise the real value of mainland GDP.

12. The fiscal rule continues to insulate the economy from commodity cycles. That insulation has been improving over time as the fluctuations in oil and gas income have a steadily smaller effect on the size of the GPFG (in proportionate terms, if not in absolute value).



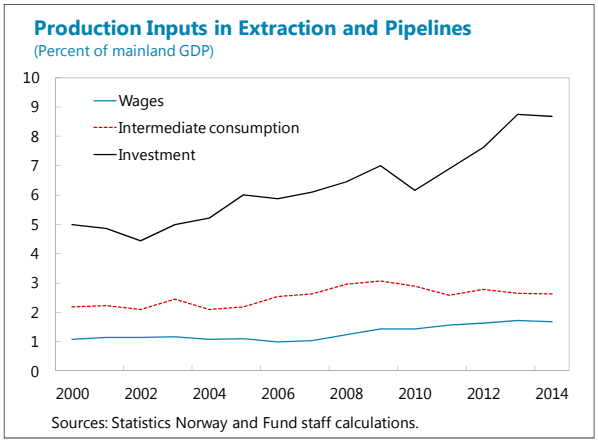
13. However, the fiscal rule has become less successful in insulating the budget from excessive fiscal stimulus. In the early years of the fiscal rule, the government tended to overspend relative to the four percent targets. More recently, government policies have been conservative relative to the fiscal rule. Nevertheless, there has been a mostly steady increase in the structural non-oil deficit even as the share of GPFG resources used each year is on a downward trend. In light of this trend, a commission was appointed by the government to consider possible supplements to the fiscal rule, and its recommendations—released in a report in June 2015—are currently being discussed.

C. Real Sector Links Between the Offshore and Mainland Economies

14. There are multiple real-sector linkages between the oil and gas sector and the real economy on the mainland and abroad. The value of the income flows through these linkages is considerably larger than the fiscal transfer from the GPFG to the budget, but they are more complicated and harder to measure. Available data tend to capture either a subset of the various flows, also include flows unrelated to oil and gas, or both.

Measuring the Links between the offshore and mainland economies

15. Total expenditure by the oil and gas sector on goods and service far exceeds the value of the transfer to the budget. 2014 wages, intermediate consumption (non wage, non-investment inputs), and investment were equal to 1.7, 2.6, and 8.7 percent of mainland GDP respectively for a total of 13 percent of GDP. The balance of payments data have entries for exports and imports of oil- and gas-related goods and services. However, these are widely regarded as greatly understating the full amounts of both imports and exports. Goods and services supplied to the oil and gas industry do not map neatly into standard industrial classification schemes. Instead, firms within individual industries have evolved to produce goods and services for the offshore sector while remaining in the same industrial classification as other firms that produce goods and services for other sectors. Consequently, some more ad hoc adjustment needs



to be made to estimate the import content of Norwegian investment, wages, and supply of goods and services to the offshore sector.

16. The import content of demand from the Norwegian continental shelf appears to be on the order of roughly 40 percent. A couple of approaches support this. A recent study from Statistics Norway attempted to estimate both the direct and indirect aspects of demand from the Norwegian continental shelf for the mainland economy using an input-output model approach (see Box 1). This study concluded that offshore demand accounts for roughly 9 percent of Norwegian employment. Similarly assuming that wages on the Norwegian continental shelf are overwhelmingly income to the Norwegian mainland, but that intermediate consumption and investment has about 40 percent direct imported content (suggested by industry sources) gives an approximation of the net income flows for supply and service from the offshore sector to the mainland of about 8.5 percent of GDP in 2014. However, there is large uncertainty around these estimates.[5] Exports of oil-related goods and services probably amount to something on the order of another 4 percent on some estimates.

Box 1. Measuring Oil and Gas Sector Demand in Mainland Economy

A Statistics Norway study—Prestmo and others (2015)—estimates the `direct' and `indirect' deliveries from various Norwegian industries to the oil and gas sector using an input-output model. Direct deliveries refer to the part of an industry's production that is supplied directly to the oil and gas sector in the form of, for example, capital goods and intermediate consumption. However, this industry may in turn uses inputs from other industries across the whole economy. The use of input-output tables can therefore trace along the production chains and identify the various inputs that are indirectly linked to oil and gas activity. This approach thus gives a more complete picture of the scale of mainland activities that are dedicated to supplying the oil and gas industry.

Results show that a wide range of Norwegian industries have links to oil and gas. These range from ship building and engineering, manufacturing, to a variety of services industries (e.g., banking and insurance, ICT services, retail). The service industry as a whole supplies about 41 percent of total investment products to the oil and gas sector, and about 43 percent of its intermediate consumption. Manufacturing plays a less prominent role, with 12.7 and 9.5 percent respectively.

Direct and Indirect Deliveries to Oil Industry

Industry	Share of industry output (%)
Services related to oil & gas	53.7
Ship-building and engineering	24.8
Research and development	15.6
Manufacturing	13.5
Transport	7.8
Electricity	6.9
Banking and insurance	6.9
Real estate	6.7
ICT services	6.0
Retail	5.6

Source: Prestmo and others (2015)

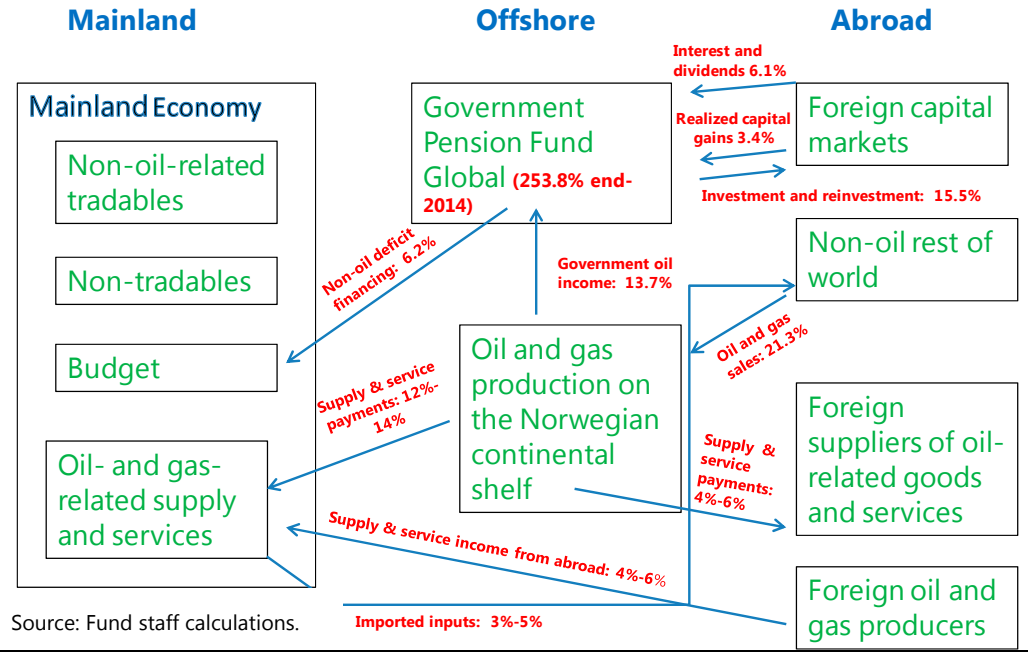
The study also provides estimates of total oil- and gas-related employment and the direct and indirect import content of service and supply to the offshore economy. In terms of employment, it is estimated that in 2014, about 240,000 workers—or 8.7 percent of the labor force—may be directly or indirectly linked to oil and gas activity. The estimated import share of inputs to the oil and gas sector (excluding direct labor) is about 40 percent: 20 percent direct, with the remainder indirect.

[5] Further complicating such calculations, not all direct import content is necessarily foreign content. A major export for Norwegian suppliers of oil and gas-related goods and services is South Korea, which in turn is a major exporter of oil platforms, some of which may find their way back to Norway containing Norwegian-sourced components.

17. Measuring exports of goods and services to oil- and gas-production elsewhere is still more challenging. Here, the main sources are survey data on revenues collected by private sources. Rystad, a major supplier of global oil and gas industry data is based in Oslo, and the Norwegian Petroleum Directorate reports its revenue estimates for Norwegian firms on its website. A second source, also based in Norway, provides estimates of total revenues based on surveys that roughly match the Rystad data on total revenues, but also attempts to break this down into revenue to the Norwegian mainland versus revenue to these Norwegian companies that represents payments to foreign employees and suppliers and therefore represents foreign rather than Norwegian value added (Mellbye et al., 2012). Combining these sources suggests that something on the order of 4 percent of mainland GDP finds its way back to mainland Norway as income to Norwegian individuals and local parts of Norwegian firms.

18. These various income flows are shown in Figure 1 together with the many more directly measurable, oil- and gas-related flows as shares of 2014 mainland GDP.

Figure 1. Oil and Gas Related Incomes, 2014
(Percent of mainland GDP)



Source: Fund staff calculations.

Growth in mainland value-added

19. Investment and supply for the oil and gas industry have grown relative to the mainland economy and provide a source of stimulus to the mainland. Total production inputs to the oil and gas sector rose from 8.4 to 13 percent of mainland GDP between 2004 and 2014. Some of this was supplied from foreign sources, but the trade balance of oil- and gas-related goods and services worsened by only 0.6 percent of mainland GDP over the same period. The net increase of 4 percent of GDP in oil and gas inputs from the mainland could be interpreted as an average annual stimulus of about 0.4 percent of GDP per year.

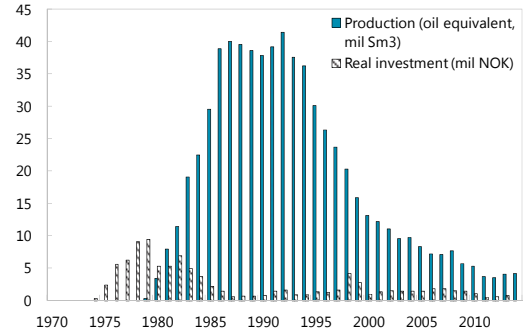
20. This stimulus will likely reverse regardless of oil and gas price developments. The relationship between oil and gas investment is not straightforward. Geology and changing technology imply different investment patterns over time that also differ across fields (see Box 2).

Box 2. Investment and Production in Norwegian Fields

The generally rising trend of aggregate oil investment masks diverse patterns across fields. At the end of 2014, there were 78 producing fields, and 11 fields being developed on the Norwegian shelf. While the general pattern is for output to peak a few years after investment in a given field, there are large differences across fields in the timing and scale of investment and output. A number of fields are close to having exhausted most of the recoverable reserves, whereas others are just coming on stream or being developed.

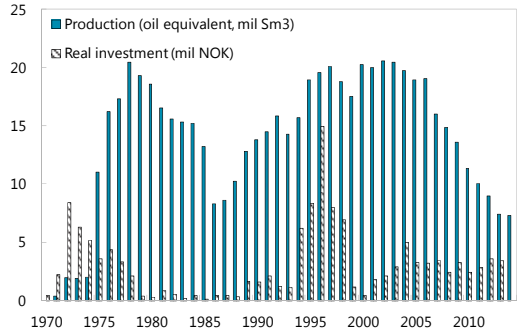
Patterns of Investment and Production in Selected Major Fields

Statfjord Oil Field



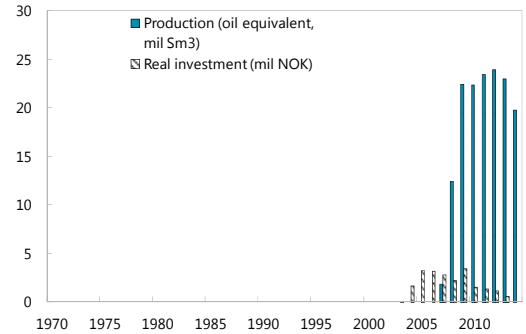
Sources: Norwegian Petroleum Directorate and Fund staff calculations.

Ekofisk Oil Field



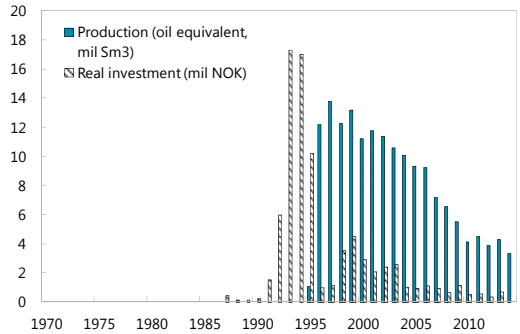
Sources: Norwegian Petroleum Directorate and Fund staff calculations.

Ormen Lange Oil Field



Sources: Norwegian Petroleum Directorate and Fund staff calculations.

Heidrun Oil Field



Sources: Norwegian Petroleum Directorate and Fund staff calculations.

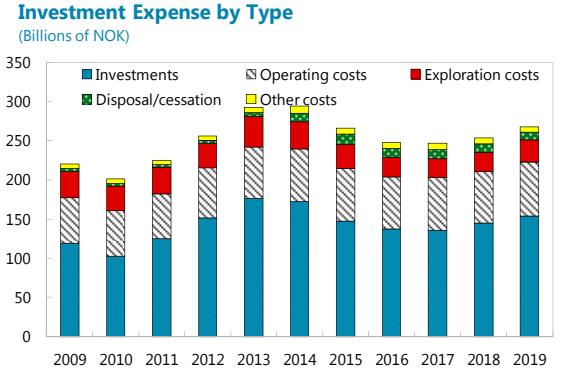
Nevertheless, the best estimates of output from the Norwegian continental shelf suggest that about half of all of the oil and gas that will be produced has already been produced. Even if oil and gas prices return to early 2014 levels, the offshore demand for investment and supply will decline. Because investment tends to take place in advance of production, the decline in investment is likely to take place somewhat earlier than the gradual decline in oil and gas production.

Implications of sustained lower oil prices

21. The mainland economy is likely to be more negatively affected by sustained changes in oil prices than the budget. While changes in oil prices and production feed through directly into

inflows into the GPFG, the very large size of existing assets in the GPFG and the influence of other factors (e.g., investment returns), and the fiscal rule would prevent these from significantly affecting transfers to the budget. However, the mainland economy would be significantly affected by cost reductions or cancelled/delayed investment over a much shorter time horizon.

22. The near-term effects on the mainland economy of low oil prices are likely to be more modest than the medium- and long-term effects if lower oil prices are sustained. However, there will be near term effects as oil and gas producers cut marginal investments and increase pressure for cost containment. Cost reductions are already being forced on suppliers and the authorities expect this to continue.



Sources: Norwegian Petroleum Directorate: "The Shelf in 2014" and Fund staff calculations.

23. Expectations of a more protracted period of low oil prices will have a significant effect on investment. Oil investment is persistent given the multi-year nature of many investment projects, and fluctuations in prices that are not expected to persist would have little effect. However, it is significantly affected by expected future oil prices over the medium term. Expectations of a sustained lower price would reduce investment over the medium term (see Box 3).

Box 3. What Determines Oil Investment and Output?

An empirical exercise aims to understand the key drivers of oil investment and output. In particular, the recent decline in oil prices, if sustained, is expected to reduce the profitability of oil companies and prompt them to cut back on new investment or delay planned investment projects. Lower investment would in turn reduce future output. In light of the complex differences in the investment and production patterns across Norwegian fields (see Box 2), it is necessary to look beyond aggregate data. We thus estimate the empirical models using investment and output data for about 70 individual producing fields over 1970–2014.

Results suggest that real oil investment positively depends on expected future oil prices. Our empirical specification follows Hvozdyk and Mercer-Blackman (2010) and uses the (inverse of) OPEC spare capacity as a proxy for expected future oil prices. Although spare capacity is highly correlated with spot and futures prices, it has been shown that spare capacity `Granger' causes the other two variables. Oil investment is also estimated to be rather persistent, reflecting the typically multi-year nature of oil projects, as well as driven by the estimated remaining reserves of a given field.

In addition, the level of oil investment has significant implications for future output. We estimate that oil production is positively related to field investment that goes as far back as six years on average. This is to be expected, as deep-water offshore drilling often involves complex and lengthy exploration phase, increasing the amount it takes for investment to translate into output.

Box 3. What Determines Oil Investment and Output? (concluded)

Model of Norwegian Oil Investment

Variable	Coefficient	Robust SE
Lagged oil investment	0.32	0.05***
Expected oil price (lag)	0.38	0.20*
Remaining reserves (lag)	1.31	0.42***
R-squared	0.19	
Observations	604	
Number of fields	68	

Source: Fund staff estimates.
Note: Dependent variable is log of real oil investment. Estimated with dynamic panel regression with field FE, for 68 oil fields over 2001-2014. Expected oil price is proxied by the inverse of OPEC spare capacity. Significance at *** 1%, ** 5%, * 10%. Alternative GMM estimation shows effect of oil price is robust.

Model of Norwegian Oil Production

Variable	Coefficient	Robust SE
Log real oil investment		
Lag 2	0.05	0.02***
Lag 3	0.04	0.02*
Lag 4	0.05	0.02**
Lag 5	0.04	0.02**
Lag 6	0.04	0.02*
Remaining reserves (lag)	2.23	0.42***
R-squared	0.47	
Observations	710	
Number of fields	63	

Source: Fund staff estimates.
Note: Dependent variable is log of oil production. Estimated with panel fixed effects, for 63 oil fields over 1970-2014. Nominal oil investment deflated with PPI index for oil and gas sector. Significance at *** 1%, ** 5%, * 10%.

24. Lower investment would ultimately lead to lower production in subsequent years. While the budget would be insulated to a very large degree through the GPFG and the fiscal rule, inflows to the GPFG would be reduced. For example, we estimate that a reduction of 10 percent in real investment would lead to a cumulative reduction of about 2.2 percent in oil output over the next 6 years (Box 3).

D. Policies for Norway's Future

25. New sources of volatility may call for amendments to the fiscal rule. A commission was recently appointed by the government to consider supplements to the fiscal rule. The commission issued its report in June 2015 with recommendations for smoothing spending and the fiscal impulse both on a year-to-year basis (e.g., limiting the change in the fiscal stance to 0.1 to 0.2 percent of trend mainland GDP per year) and over the medium and longer term. The Norwegian government is currently considering the recommendations of the commission along with other options to more explicitly smoothing over asset price and exchange rate cycles in addition to smoothing over the business cycle. Also, consideration could be given to a more explicit approach to limiting the non-oil deficit below the estimated real return in times when the economy is at or near potential. The recommendations of the commission have the advantage of simplicity, but they might not be as effective in circumstances where one particular source of stimulus or drag from the fiscal rule required a more aggressive response than smoothing.

26. Labor market policies could help to free up workers and facilitate their move to other sectors. Given the gradual and long-foreseen nature of the decline in investment, it may not be necessary to adopt special policies to redeploy workers and other resources from oil-related business to other businesses. However, greater wage differentiation across sectors could attract workers to new sectors rather than waiting until layoffs make such a move necessary. In the absence of wage differentiation, policies to discourage labor hoarding, improve information about economic prospects in different industries, and active labor market policies such as retraining could help ease the transition.

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THE HOUSING BOOM AND HOUSEHOLD DEBT IN NORWAY[1]

The Norwegian housing market was only moderately affected by the global financial crisis, and the rising trend of house prices resumed shortly after the crisis. In the meantime, household debt reached more than 200 percent of disposable income, and it is expected to grow further. This paper examines the characteristics of household debt and various factors driving the housing boom and debt accumulation, with a particular focus on institutional factors. The paper also examines the vulnerability stemming from the high level of household debt and the potential macroeconomic impact of a possible house price correction.

A. House Prices and Household Debt

1. Norway has seen a long housing boom (Figure 1). House prices have been rising since the early 2000s apart from a short reversal during the global financial crisis. The increasing trend of house prices continued in recent years until 2013 when house prices stabilized with no clear trend and credit to households continues to grow. Estimates suggest that house prices may be overvalued by about 25–60 percent, depending on measures of overvaluation.[2, 3]

2. Household indebtedness has also risen significantly for the past decades. Household debt was about 140 percent of disposable income in 2002 and now it stands at about 220 percent of disposable income in 2014, which is among the highest in OECD countries. Household debt is heavily skewed toward housing, with about 85 percent in the form of mortgages from banks and mortgage companies.

3. Household assets are mostly illiquid. A large portion of household assets consists of housing wealth and pension assets. Liquid assets such as deposits and shares are relatively small at about 150 percent of disposable income. As a comparison, liquid assets in Sweden and Denmark are about 300 percent and 250 percent of disposable income, respectively (Figure 1).

[1] Prepared by Giang Ho and Kazuko Shirono.

[2] These estimates are calculated from deviations in price-to-income ratio and price-to-rent ratio, and also based on a model used in the early warning exercise. See IMF (2013) for more details on the methodology.

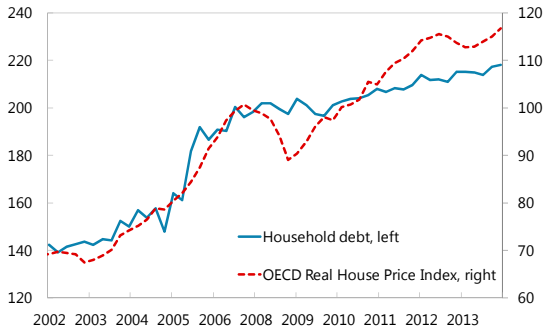
[3] The price-to-rent ratio is often used to gauge house price misalignment, but rent series tend to imperfectly capture rent developments in practice. In Norway, the rent series is thought to capture mostly the rent developments of existing rental contracts, which tend to move at the rate of CPI inflation due to regulations. This tendency could lead to an overestimation of house price gaps using the price-to-rent ratio. In addition, the rental market in Norway, being relatively small and very different from the owner-occupied market, provides limited substitutes for the owner-occupied housing market, which makes the price-to-rent ratio an imperfect measure of house price valuation particularly for Norway.

Figure 1. House Prices and Household Balance Sheets

House prices have kept rising since 2009 except a short pause in 2013…

House Prices and Household Debt

(Percent of disposable income, left; Index: 2010=100, right)

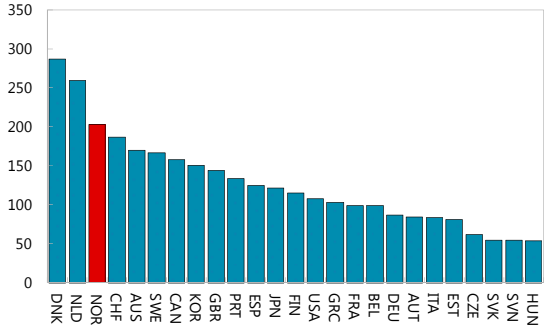


Sources: OECD, Haver Analytics, and Fund staff calculations.

… and household debt is among the highest in OECD countries.

Household Debt

(Percent of disposable income, 2013)

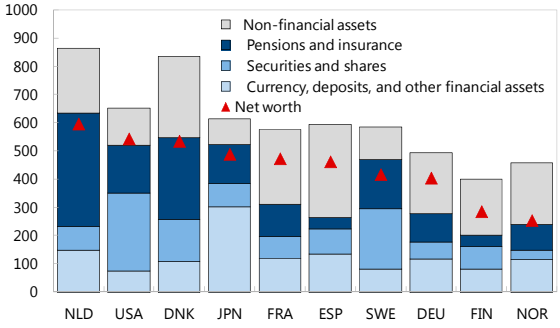


Sources: OECD and Fund staff calculations.

Household assets are mostly illiquid such as housing and pension assets.

Composition of Household Assets

(Percent of disposable income, 2013)

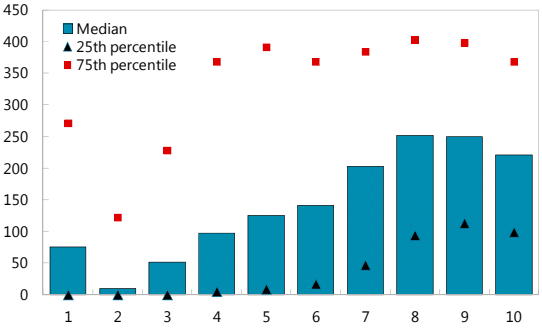


Sources: OECD and Fund staff calculations.

Median debt is higher among higher income families while some lower/middle income households are also highly indebted.

Distribution of Household Debt by Income Decile, 2013

(Percent of disposable income)

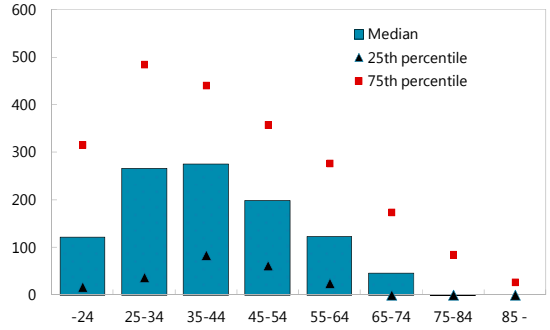


Sources: Statistics Norway , Norges Bank, and Fund staff calculations.

Very high debt is more concentrated among younger families…

Distribution of Household Debt by Age, 2013

(Percent of disposable income)

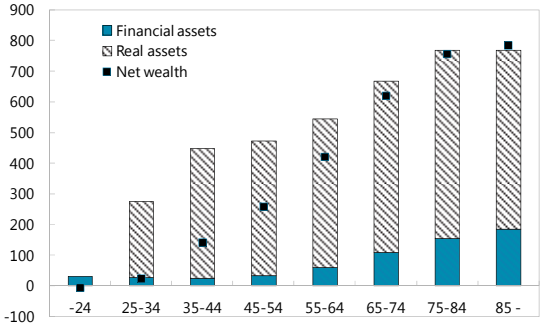


Sources: Statistics Norway, Norges Bank, and Fund staff calculations.

… and these families tend to have small financial assets and net wealth.

Distribution of Household Assets by Age, 2013

(Median, Percent of disposable income)



Sources: Statistics Norway, Norges Bank, and Fund staff calculations.

4. Household net worth is positive but smaller than peer countries. One caveat, however, is that household balance sheets may not fully capture the fact that Norwegian households have large pension assets through the social security system and through occupational pension schemes. Household balance sheets data capture only voluntary individual pension savings, which is relatively modest in size compared with peer countries. On the other hand, social security pension liability was 5.7 trillion NOK, about 412 percent of disposable income in 2013.[4] This suggests that Norwegian households' assets are larger than what is found in data on household balance sheets in practice. Nevertheless, limited liquid buffers could make Norwegian households vulnerable to sharp house price corrections.

5. Household debt is concentrated more among higher income households (Figure 1). Median household debt tends to be higher among higher income families. However, the distribution of debt looks quite different across households depending on the age of main income earners; younger households tend to have more debt, and very high levels of household debt tend to be skewed more toward younger households. These households also tend to have smaller assets, particularly financial assets.[5] Young households are thus likely to be more vulnerable to house price corrections or a sharp interest rate hike because they have limited liquid buffers with most of their assets held in illiquid housing. Household vulnerability will be examined further in Section C.

B. Institutional Factors Behind the Housing Boom and Household Indebtedness

6. Various factors can contribute to rising house prices and household indebtedness. These include demand factors such as income growth or population growth and low interest rates and supply factors such as shortage of housing. Other factors are more institutional or structural, such as the size of rental market or rental market regulations and tax incentives including interest deductibility of residential mortgages (IMF, 2015).

7. In the Norwegian context, both demand and supply factors have contributed to the housing boom and rising household debt. Demand factors include high wage/income growth reflecting the oil sector boom, population growth due to the large influx of immigrants, and low interest rates in recent years. Supply factors include constraints due to regulations on land use, minimum unit size, and other construction standards (IMF, 2013). According to an OECD estimate, Norway has a relatively low price responsiveness of housing supply, possibly reflecting both natural land constraints and regulations; the long-run price elasticity of new housing supply is estimated at about 0.5, compared to an OECD average of 0.7.[6]

[4] The National Budget 2015.

[5] Non-financial assets from the household level data are significantly larger than non-financial assets reported in aggregate OECD data. The difference is due to different valuations of real assets. Household level data use market values to evaluate real assets.

[6] See Caldera Sanchez and Johansson (2011) for detail.

8. Structural or institutional factors are also important in explaining household indebtedness in Norway.

- The rental market in Norway is relatively unregulated but limited in size. Norway's private and public rental combined accounts for about 23 percent of the total dwelling stock, compared to an average of 38 percent for other Nordic countries (Denmark, Finland, and Sweden). Thus, individuals tend to enter the owner-occupied housing market and take mortgages at a relatively younger age.

- The tax system also plays a role as owner-occupied properties receive preferential tax treatment relative to other investment. Home ownership is generally encouraged by tax incentives:

    - Mortgage interests payments are fully tax deductible (at a tax rate of 27 percent).

    - The imputed rent from home ownership is tax exempt, and a homeowner can rent out part of a property tax free.

    - Housing is subject to a lower wealth tax than other assets (25 percent of market value of primary dwellings and 70 percent of market value of secondary dwellings).

    - There is no capital gains tax if a house has been owned for more than a year and the owner has used it as their own home for at least 12 out of the last 24 months.

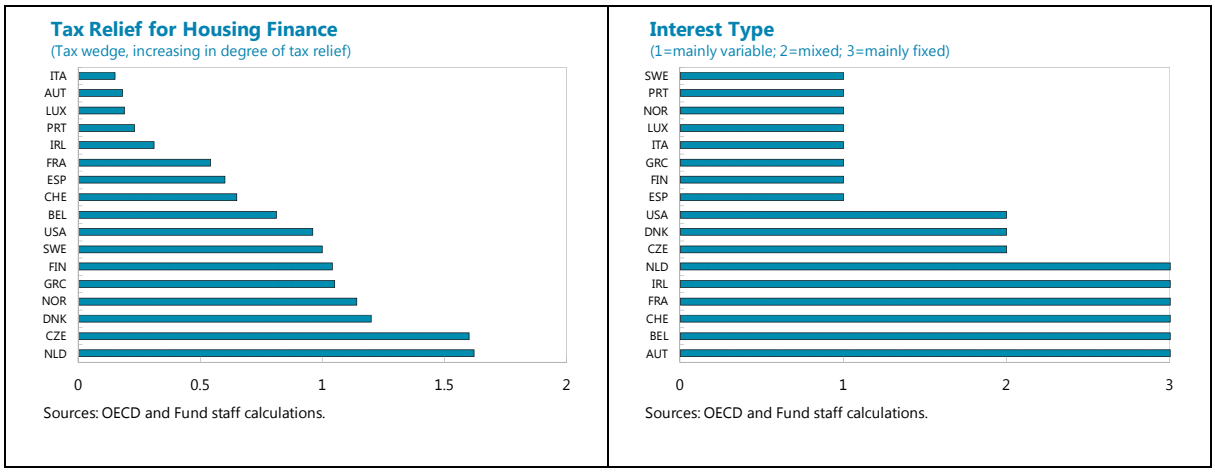
    - Saving for house purchase is encouraged by tax deductions on a savings scheme for house purchase by persons under 34 years of age. Under this savings scheme, one can save maximum NOK 200,000 in total and NOK 25,000 per year. 20 percent of what is saved during a year is tax deductable. Savings under this scheme need to be used for purchasing a house or repaying mortgage debt. Otherwise tax advantages will be reversed.

Indeed, Norway ranks among the OECD countries with the highest degrees of tax relief on debt financing cost of homeownership, according to an indicator constructed by the OECD.[7]

- Supply constraints are likely to push up house prices especially when house completions are running behind the growing number of households. This will create a need to take up a larger mortgage than otherwise. It is likely that supply constraints are partly due to strict planning restrictions that are imposed on new house building.

- The prevalence of variable rate mortgages may also contribute to encouraging household debt accumulation, by reducing interest payments in a low interest rate environment. About 95 percent of mortgages in Norway have variable rates.

[7] The indicator takes into account if interest payments on mortgage debt are deductible from taxable income and if there are any limits on the allowed period of deduction or the deductible amount, and if tax credits for loans are available.



9. A regression analysis confirms that these factors are important in explaining credit booms in a cross-country context. To analyze the buildup in household leverage, a panel probit model to predict the probability of a household credit boom was estimated using data on 24 OECD countries for 1970Q1–2013Q4.[8] Explanatory variables include house prices, mortgage characteristics (e.g., interest type and tax relief for housing finance), financial system characteristics (e.g., loan-to-deposit ratio, pension assets as a share of disposable income), and macroeconomic and financial factors (e.g., unemployment rate, working age population growth, and the short-term interest rate). Regression results suggest that these variables contribute to explaining the occurrence of household credit booms, albeit to varying extents. For example, other things constant, the presence of a house price boom is estimated to increase the probability of a household credit boom by 27 percentage points, whereas countries with predominantly variable mortgage rates are likely to face higher probability of a credit boom by 13 percentage points compared to those with mainly fixed rates.

10. The estimated model suggests that Norway possesses several factors that make a household credit boom more likely to occur. For example, using data for 2010–13, rapidly rising house prices in Norway, by raising the value of collateral available to households, would add about 6 percentage points to the probability of a credit boom relative to average OECD level. Switching to a mortgage system with predominantly variable rates such as one in Norway would add another 8 percentage points to the estimated probability. Norway's more generous tax system regarding housing finance relative to OECD average adds another 3 percentage points, and the

Estimated Probability of a Household Credit Boom

	Prob.	Std. Err.
Average advanced OECD, 2010-13	0.23	0.03
+ NOR probability of house price boom	0.29	0.04
+ NOR interest rate type (mainly variable)	0.37	0.05
+ NOR tax relief for housing finance	0.40	0.05
+ NOR change in unemployment rate	0.41	0.05

Source: Fund staff calculations.

Note: Predicted probabilities from the probit model, using average 2010-13 values for the explanatory variables.

[8] See Arnold and others (*forthcoming*).

relatively low unemployment rate contributes another percentage point to the credit boom probability.

C. Household Vulnerability

11. Despite high debt levels in recent years, Norwegian households do not appear to face significant payment capacity problems under current conditions. Non-performing loans are near historical lows. A Norges Bank study using the 2012 household-level data found that only about 2 percent of household debt is "more vulnerable," and the proportion of vulnerable households is only about 1 percent.[9] These results are based on household debt meeting three risk criteria: (i) debt above five times disposable income; (ii) financial margin (income minus taxes, interest and ordinary living expenses) below one month of annual after-tax income[10]; and (iii) net debt (debt minus deposits) larger than the value of dwelling. Household debt is considered risky if these indicators are higher than the threshold.

12. However, households appear vulnerable to interest rate hikes. The FSA has analyzed the impact of an interest rate hike on households' interest burden using Statistics Norway's micro simulation model based on household-level data.[11] The interest burden is defined as interest expenses as a share of income after tax. The analysis finds that households are sensitive to interest rate hikes: an increase of the lending rate by 2 percentage points would double the proportion of households with an interest burden between 20 and 30 percent, from 5.5 percent to 12 percent. At the same time, the proportion of households with an interest burden above 30 percent would more than double from 2.5 percent to 7 percent.

13. To gain insights into households' vulnerabilities to a change in economic conditions, the Norges Bank approach was expanded to include a set of shocks.[12] These shocks are included separately and combined: (i) lending rate increase of 2 percentage points; (ii) real house price drop by 40 percent;[13] and (iii) income drop of 20 percent.[14] The results are summarized as follows:

[9] See Norges Bank, Financial Stability Report 2014. Related studies include Solheim and Vatne (2013), Lindquist et al. (2014), and Lindquist and Vatne (2014).

[10] See Box 1 for a sensitivity analysis on this assumption.

[11] See Finanstilsynet, Risk Outlook 2014, and Risk Outlook 2013.

[12] Norges Banks also conducts various sensitivity analyses using this framework. See, for example, Lindquist et al. (2014).

[13] Deposit rates are also assumed to rise by 3 percent at the same time.

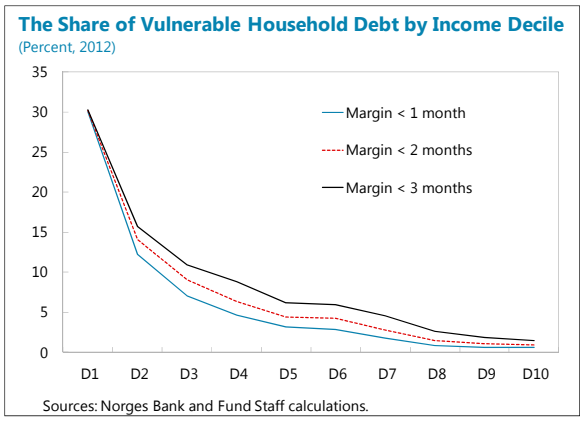
[14] Parameters are calibrated based on similar shocks assumed in the bank stress test in the 2015 Norway FSAP exercise.

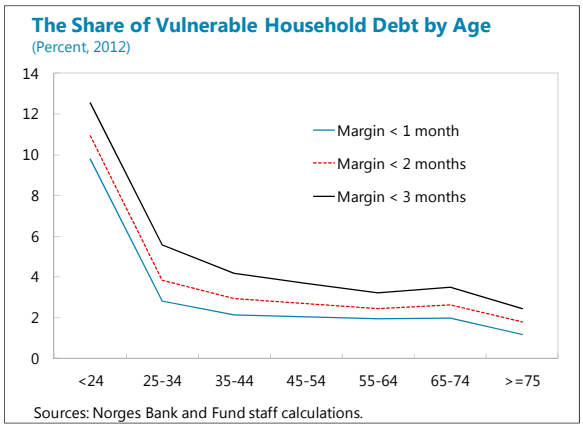
Box 1. Sensitivity Analysis

The Norges Bank's approach applies three criteria. One of the criteria based on "margin" is calculated as income minus taxes, interest, and ordinary living expenses. Ordinary living expenses are based on the Standard Budget complied by National Institute for Consumer Research, which is a standardized estimate of the standard cost of consumption and does not necessarily reflect individual circumstances of households. This measure thus entails some uncertainty while two other risk measures are directly observable. Ordinary living expenses are likely to vary depending on household income levels, and the estimate may also not be capturing other necessary expenses.

To take account of potential overestimation of margin, different definitions of margins are applied. Margins below two months and three months of income were also applied as a sensitivity analysis, and baseline results were recalculated. Using the three combined criteria, the share of vulnerable household debt increases from 2 percent under the baseline with one-month margin to 3.2 percent and 4.4 percent if 2 month-margin and 3 month-margin are applied, respectively. These are still relatively small share, but different assumptions seem to affect different age/income groups somewhat differently. The share of vulnerable debt tends to be higher among lower income and younger households, and the share is 1–4 percentage points higher if 3 month-margin is used instead of 1 month-margin. This variability tends to be more pronounced among income groups 3–5 and age groups between 25–34 years old.

The results for the first decile (D1) and the youngest households (younger than 24 years old) need to be interpreted with caution. Households in the lowest income decile include households that engage in tax planning. Their reported income may be low, but they are likely to have high debt servicing capacity. The age group below 24 tends to hold student loans as part of their debt and has more flexible options regarding principal payments if their income is low. Importantly, both groups hold a very small share of total household debt.





- The share of vulnerable debt rises from 2 percent in the baseline to about 5 percent, 6 percent, and 8 percent, under each separate scenario, respectively. However, the proportion of vulnerable households rises but remains relatively low, below 3 percent in all three individual scenarios. On the other

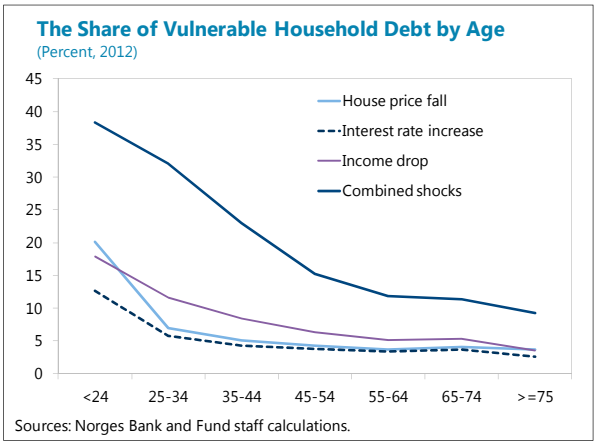
Share of Household Debt and Households Breaching the Three Criteria *(Percent)*

	Debt	Households
Interest rate increase	4.6	1.9
House price fall	5.5	2.5
Fall in income	8.1	3.4
Combination of the three shocks	21	8.6

Sources: Norges Bank and IMF staff calculations.
Note: Margin below two months after-tax income was used for the second criterion.

hand, under the severe scenario of combined shocks, the share of vulnerable debt increases to 21 percent, and the proportion of vulnerable households also rises to about 9 percent.

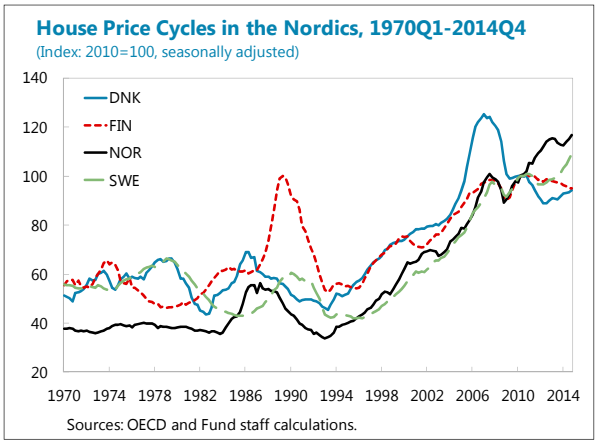
- The impact varies across different income deciles and age groups. In particular, lower income and younger households are disproportionally more affected by the three combined shocks. For example, roughly 30 percent of the debt held households aged 25–34 years are vulnerable under the severe scenario of combined shocks.[15]



14. The aggregate number masks distributional effects. The proportion of vulnerable households remains below 10 percent under the severe scenario, but this share is larger for certain income or age groups. The exercise above thus suggests that household vulnerability could rise under severe stress scenarios, and these effects will be felt unevenly across different income and age groups.

D. Macroeconomic Impact of a House Price Correction

15. What are the possible aggregate impacts of a house price correction? Given that a significant part of Norway's household debt lies in housing, it is natural to ask how house price corrections in the past have affected household consumption and residential investment. Theory postulates that changes in house prices can have an effect on individual consumption through their impact on household wealth and access to finance via relaxation/tightening of collateral constraints. The household-level analysis in the previous section shows that more households in Norway could become "vulnerable" in the event of a negative shock to house prices; however, whether that translates into more defaults or a cutback in consumption and investment is an empirical question.



16. It is useful to examine past experiences with house price corrections in Norway and other Nordic countries. Since the mid 1980s, the Nordic countries have undergone two major episodes of house price collapse, one around the banking crises of the mid-to

[15] These results need to be interpreted with caution. About 40 percent of the debt held by household younger than 24 years old is vulnerable under the combined shock scenario, but these households hold less than 3.5 percent of total household debt, and close to 30 percent of their debt is student loans, which are interest free as long as borrowers remain in school. On the other hand, households aged 25-34 years hold more than 20 percent of total household debt. Thus the vulnerability of the latter group of households is likely to be more significant than the very young households.

late-1980s and one during the 2008–09 global financial crisis. In all four countries, the decline in house prices in cumulative real terms tends to be much larger and more persistent during the first episode, whereas the house price corrections that happened during the most recent crisis seem relatively milder and less long-lasting (perhaps with the exception of Denmark, which had experienced a much more pronounced housing boom previously). In Norway, for example, real house prices declined by a total of 67 percent over almost six years in the late-1980s crisis, compared to only 13 percent over five quarters during the recent global crisis. Better macroeconomic management and bank regulation may have played a role in containing house price overvaluation during the boom and supporting the recovery of the housing market after the bust, resulting in less severe price corrections. However, the decline in real private consumption for every percent of house price decline has increased in the recent episode, possibly reflecting much more developed mortgage markets and thus closer links between the housing sector and the real economy.

Price and Consumption Decline in Past House Price Corrections

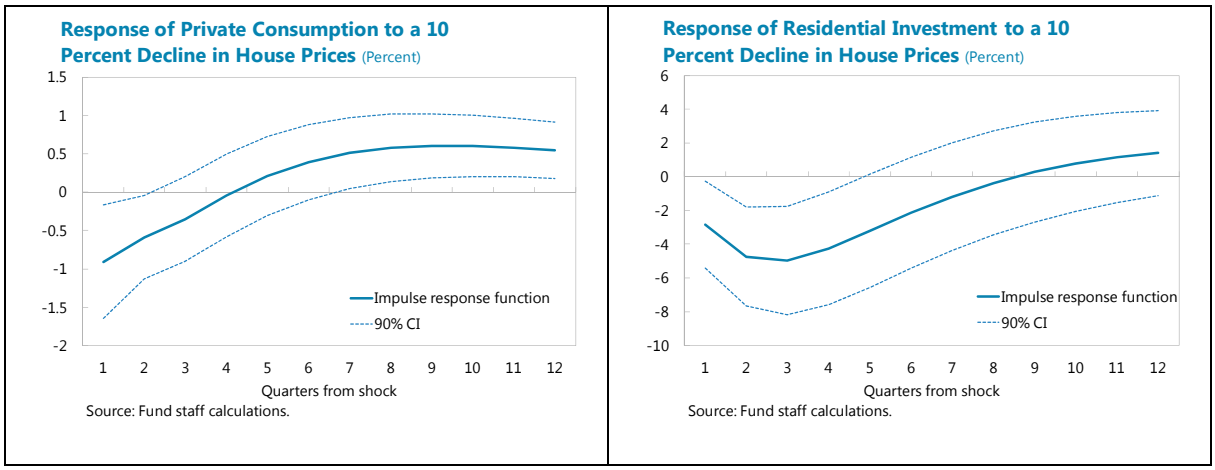
(Percent, cumulative)

	Norway	Sweden	Denmark	Finland
Peak-trough of HP cycle	--	79Q1-85Q3	79Q2-82Q3	73Q4-79Q1
Price decline	--	54.3	52.9	42.0
Consumption decline	--	--	--	--
Peak-trough of HP cycle	87Q2-93Q1	90Q1-93Q3	86Q2-93Q2	89Q2-93Q2
Price decline	66.8	43.9	51.5	89.9
Consumption decline	4.2	9.4	--	12.2
Peak-trough of HP cycle	07Q3-08Q4	07Q4-09Q1	07Q1-12Q2	07Q3-09Q1
Price decline	13.1	6.7	40.9	9.2
Consumption decline	3.7	2.9	5.9	4.7

Source: Fund staff calculations.
Note: The contraction phase in a house price cycle (period between peak and trough) is defined as at least two consecutive quarters of falling real house prices.

17. A Vector Auto-Regression (VAR) framework is used to assess the average impact of a house price shock. A model is estimated separately for each outcome variable: GDP, private consumption, and residential investment. Following Igan and Loungani (2012), the VAR includes three other variables: CPI, short-term interest rate, and house prices. House price shocks are identified through a Cholesky decomposition of the variance-covariance matrix.[16] The model is estimated using quarterly data for all four Nordic countries. Data for Norway span 1986Q1–2014Q4, and thus capturing both historical house price correction episodes discussed above. Estimation results suggest that for Norway, a 10 percent decline in house prices would lead household consumption to fall by almost one percent on impact. The effect is relatively short-lived, reaching cumulative 1.5 percent after two quarters before rebounding. The impact on residential investment is estimated to be larger, lasting about a year with a cumulative decline of 17 percent. Thus, if the past is any indication of the future, the aggregate consumption impact of a potential house price turnaround in Norway would not be severe, perhaps due to the availability of other household assets that can be drawn to avoid a drastic cutback in consumption. Nevertheless, the effect could be large for younger families with more debt and fewer assets, which is not captured in this aggregate analysis.

[16] In particular, the ordering of variables in the VAR is as listed above. An assumption is that macroeconomic variables are affected by monetary policy only with a lag while monetary policy responds contemporaneously to changes in all variables in the system. The house price variable enters last, allowing house prices to respond instantly to macroeconomic variables and monetary policy.



18. The estimated macroeconomic impact of a house price correction appears milder for Norway compared to Nordic peers. For example, in response to a 10 percent drop in house prices, the maximum decline in private consumption in a given quarter is estimated at 0.9 percent in Norway, compared to 2.1 percent in Sweden and 3½ percent in Denmark. The cross-country heterogeneity in responses is even more pronounced in the case of residential investment. Previous literature (e.g., IMF, 2008; Cardarelli and others, 2009) suggests that mortgage market characteristics defining the ease of access to credit (e.g., typical loan-to-value ratio, availability of mortgage equity withdrawal to finance consumption, prevalence of variable vs. fixed rate mortgages) could be among factors explaining why economic activity in some countries may be more vulnerable to declining house prices than in others.

Maximum Impact of a 10 Percent Decline in Real House Prices
(Percent)

	Private consumption	Residential investment	GDP
Norway	-0.90	-4.97	-0.42*
Sweden	-2.06	-9.35	-3.99
Denmark	-3.54	-12.30	-3.52
Finland	-2.03	-6.23	-2.34

Source: Fund staff calculations.
Note: * indicates not statistically significant.

E. Conclusion

19. High household debt is an underlying vulnerability for Norway. Risks seem contained so far, but this could change if economic conditions deteriorate significantly. The authorities have implemented several measures, including stricter bank capital requirements in line with Basel III/CRD IV (ahead of schedule) and tightening parameters for risk weights on mortgage lending of IRB models. More recently, the FSA has proposed tighter underlying mortgage loan standards, including a requirement to amortize mortgages, applying a higher stress level for interest rates in assessing borrower's repayment capacity, and reduction in banks' scope for deviating from these requirements.

20. A holistic approach will be needed to address risks associated with high house prices and household debt. Macroprudential policy measures play a key role to contain financial stability

risks, but other supporting measures will be needed to address the issue more fundamentally. Possible options include the following:

- **Reducing tax preferences for owner-occupied housing and mortgage debt:** There are several tax incentives that encourage home ownership in Norway including full deductibility of mortgage interest as discussed earlier. Given the current low interest rate environment, which limits the effective benefit of interest deductibility, now seems to be a good time to start reducing mortgage interest deductibility. More recently, the Tax Commission has recommended shifting the tax burden toward indirect taxes and advocated less preferential tax treatment for residential housing relative to other assets. Its recommendations include removing the home savings scheme for young people, repealing the tax exemption on rental income up to 50 percent of the market value of private residences, and increasing the valuation of properties. These measures could be phased in gradually.

- **Easing supply constraints:** Planning and building requirements could be relaxed to stimulate the supply of new housing units. The Ministry of Local Government and Modernisation is working on various measures to simplify regulations on planning and building matters, with a goal to help keep construction costs down and to increase the pace of planning processes.

- **Development of rental market:** As noted earlier, the rental market in Norway is relatively small. This is likely to be, at least partially, the result of existing tax incentives that encourage home ownership. The role of rental market could be revisited in light of the growing number of immigrants whose housing need may differ from native Norwegians. Availability of rental housing may also facilitate labor mobility across cities as the Norwegian economy transitions to less oil dependent growth model and goes through structural changes.

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THE NORWEGIAN LABOR MARKET AND MIGRATION[1]

The unemployment rate has been low in Norway, but there is a large group of people who are excluded from the labor market: many people receive disability benefits with high inflow into disability and very little outflows. Sickness absence incidence and expenditure on health-related benefits are the highest among OECD countries. Moreover, Norway has been receiving a large number of non-Nordic labor immigrants in recent years, and this has added new dimensions to the landscape of the Norwegian labor market. This paper discusses labor market issues in Norway and reviews stylized facts about immigration in comparison with other OECD/Nordic countries. The paper also examines labor market implications of immigration and related policy challenges.

A. Labor Market Institutions in Norway

1. Norway's labor market institution is often characterized as the "Nordic model." The Nordic model has three distinctive features: (i) flexible hiring and firing of economic reasons; (ii) a generous social safety net; and (iii) active labor market policies. The purest form of this model is found in Denmark and known as "flexicurity." While labor markets in Nordic countries share these labor market features, the relative importance and emphasis of these elements vary across countries. For example, according to OECD indicators, the degree of employment protection for regular contracts is only slightly higher in Norway than in Denmark while temporary contract employment is much more protected in Norway than in Denmark. Similarly, unemployment benefits net replacement rates for short-term employment are slightly higher while long-term unemployment benefits are slightly less generous in Norway than in Denmark (Figure 1).

2. Another key element of the Nordic model is the role of labor unions. The Nordic labor markets are not as heavily regulated as other European markets, and collective agreements serve the functions that legal regulations do in other European countries. Nordic countries have the highest union density among OECD countries, and Norway is no exception—although to a somewhat lesser extent than the Nordic neighbors (Figure 2). Centralized bargaining supported by high union density results in smaller wage dispersion – Norway, together with other Nordic countries, have among the lowest wage dispersion rate for OECD countries. Indeed, the wage bargaining system in Norway is considered one of the most highly centralized and coordinated among the OECD countries.[2]

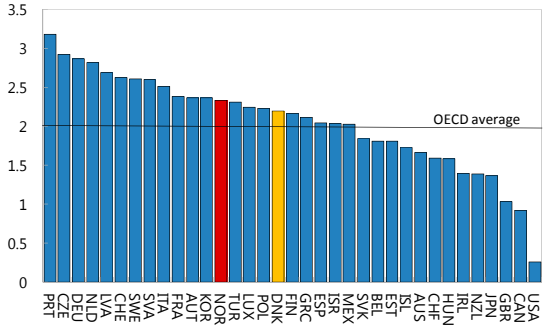
[1] Prepared by Giang Ho and Kazuko Shirono.

[2] Tripartite framework agreements decide on major parameters. At the national level, the union confederations and national employers associations set the framework for collective bargaining through the basic agreements, which are negotiated every four years. Collective bargaining takes place at the sectoral level, with manufacturing (the tradable goods sector) setting the norm for the wage growth in the rest of the labor market (sheltered sector). See e.g. Loken and Stokke (2009).

Figure 1. Labor Market Institutions

Employment protection for regular workers is somewhat higher in Norway than in Denmark…

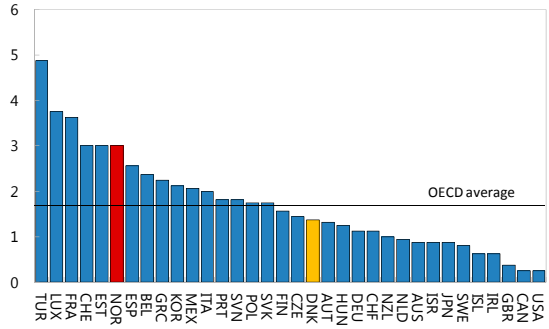
Employment Protection Regular Contracts
(Index, 2013)



Sources: OECD and Fund staff calculations.

…while workers with temporary contracts are substantially more protected in Norway than in Denmark.

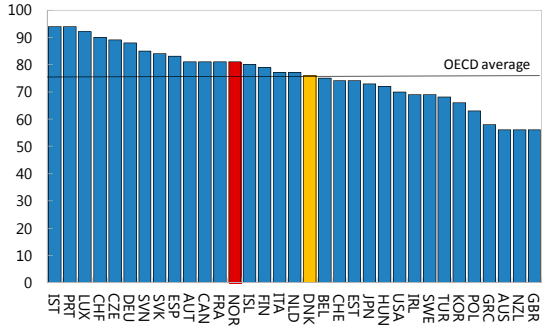
Employment Protection Temporary Contracts
(Index, 2013)



Sources: OECD and Fund staff calculations.

Short-term unemployment benefits are somewhat more generous in Norway than in Denmark…

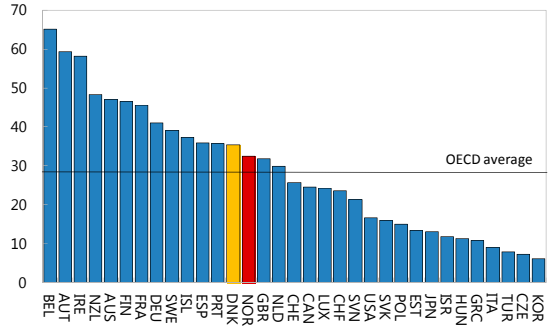
Unemployment Benefits Net Replacement Rates
(Percent of short-term unemployment)



Sources: OECD and Fund staff calculations.

…but the long-term unemployment benefits are slightly lower than in Denmark.

Unemployment Benefits Net Replacment Rates
(Percent, over 60 months of unemployment)



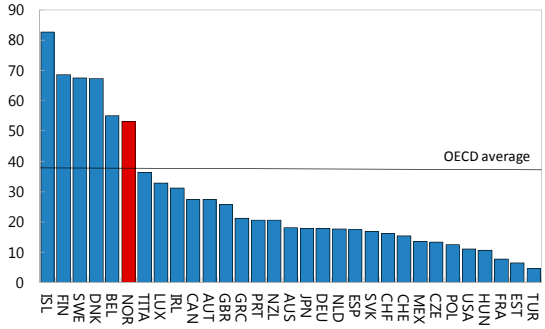
Sources: OECD and Fund staff calculations.

3. The collective bargaining process in Norway has supported high wage growth throughout the economy in recent years. Manufacturing—the sector exposed to foreign competition and the one that needs to be more competitive than non-exposed sectors—is the lead sector for wage negotiations and has seen strong wage growth for the past years. Manufacturing sets the stage, and other sectors follow the lead. In this way, collective bargaining ensures that high wage growth in competitive export competing sectors is shared by the entire population through high wages in other sectors as well. But if wages are set too high relative to productivity, the market will not clear, and unemployment will result. Generally in the Nordic model, flexible labor market and social safety net are expected to avoid common causes of structural unemployment by fostering adjustment, and help keeping the participation rates high; and active labor market policies play an important role to support high wage floors with low unemployment by subsidizing low-productivity workers. In Norway, however, active labor market measures are targeted for certain groups of people, and the usage of these measures (measured by spending on such measures) is relatively limited.

Figure 2. Labor Market Outcomes

Union density is high in Norway and labor unions play an important role in collective bargaining…

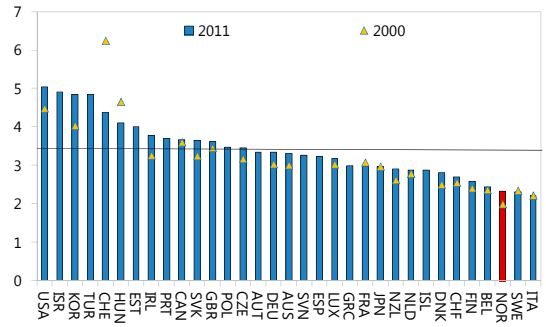
Trade Union Density
(Percent, 2012)



Sources: OECD and Fund staff calculations.

…resulting in small wage dispersion in Norway, well below the OECD average.

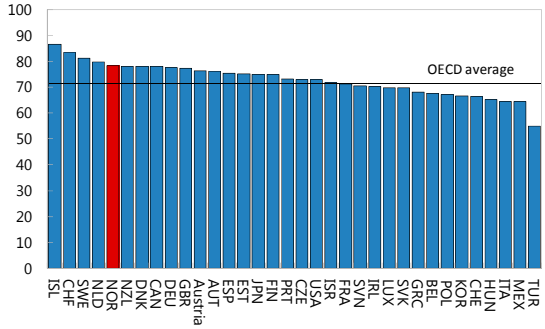
Wage Dispersion
(Ratios of gross earning, decile 9/decile 1)



Sources: OECD and Fund staff calculations.

Labor participation rate is high in Norway…

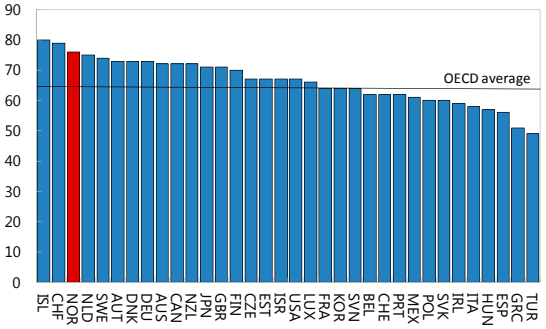
Labor Participation Rate
(Percent, 2013)



Sources: OECD and Fund staff calculations.

… and so is employment rate.

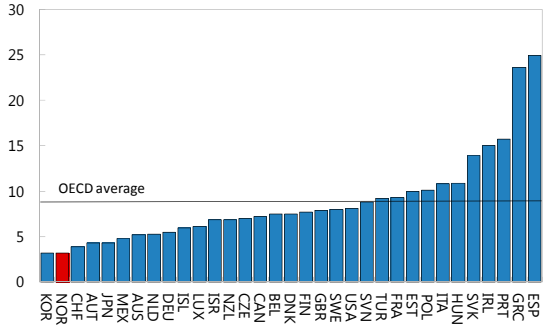
Employment Rate
(Percent of working population, 2012)



Sources: OECD and Fund staff calculations.

Unemployment rate is among the lowest in OECD countries, in part reflecting robust growth in recent years.

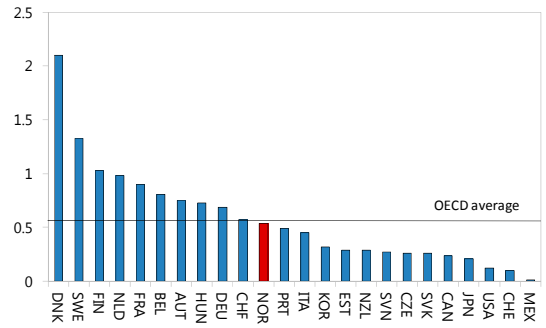
Unemployment Rate
(Percent, 2012)



Sources: OECD and Fund staff calculations.

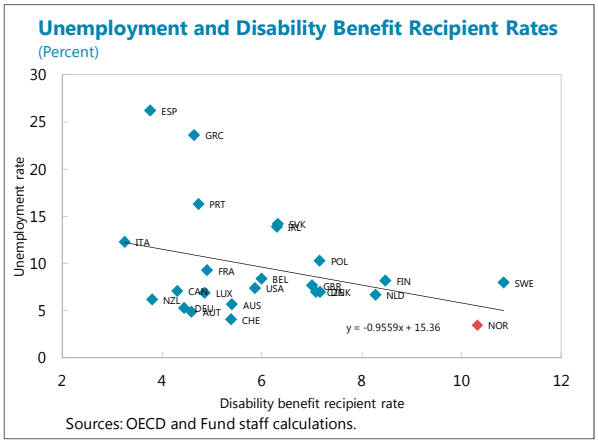
Low unemployment rate partly explains lower expenditure on active labor market policies than other Nordics.

Labor Maket Policies Active Measures
(Percent of public expenditure)



Sources: OECD and Fund staff calculations.

4. There has been tension between the generous social safety net and incentives to work in Norway. The unemployment rate in Norway is one of the lowest among OECD countries (Figure 2). However, there is a large group of people who have fallen out of the labor market: many people receive disability benefits, and there are high inflows into disability cases and a very low rate of outflows.[3] Sickness absence incidence in Norway is the highest among the OECD countries, and so is expenditure on health related benefits, which is more than 5 percent of GDP (Figure 3). About one-fifth of the working age population receives income supports related to health problems or disability, which is nearly everybody who is not working. Disability benefit recipients are thus sometimes considered as "disguised" unemployment or early retirement in Norway.[4] This is not surprising; there is an inverse relationship among European countries between the unemployment rates and the disability benefit recipient rates; economies with low unemployment often have high disability rates, suggesting that the two forms of labor market insurance tend to be used as substitutes.



Sources: OECD and Fund staff calculations.

5. The high dependency on health-related benefits in Norway contrasts with the low usage of unemployment benefits. The length of unemployment benefits and average net replacement rates (currently two years and 62.4% respectively) are relatively generous in Norway, but the use of unemployment benefit is among the lowest in OECD countries. This is partly due to stricter eligibility criteria and other requirements for unemployment benefits, including the requirement for an unemployed person to accept any job anywhere in the country. In order to receive benefits, the unemployed person is also required to regularly report his/her unemployment status (every two weeks) and job search activities will need to be reviewed every three months. Sickness pay is available for employees who are absent from work due to a health problem (certified by a physician), with a replacement ratio of 100 percent up to a ceiling. Eligibility for receiving disability insurance benefits requires that work ability is reduced by at least 50 percent. In reality, there is a large grey area between unemployment and disability, and prior research has found that a significant fraction of disability insurance claims are triggered by job loss (see e.g. Bratsberg and others, 2010).

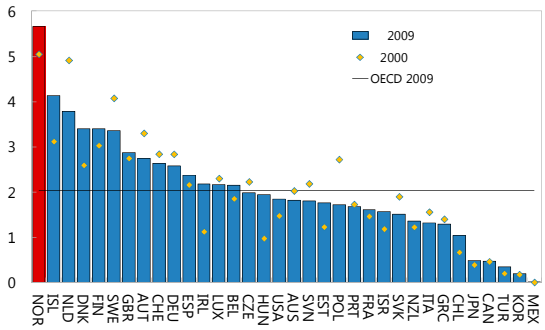
[3] See OECD (2013).

[4] See Duell and others (2009). They note that an important share of the population outside of the workforce due to illness and disability in Norway would be classified as unemployment benefit recipients or social assistance recipients in other OECD countries.

Figure 3. Disability Benefit and Sickness Leaves

Norway spends the most on disability and sickness among the OECD.

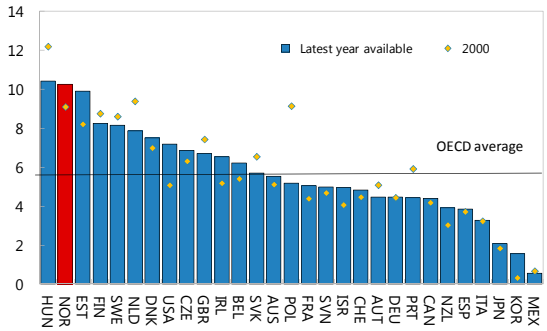
Expenditure on Disability and Sickness
(Percent of GDP)



Sources: OECD and Fund staff calculations.

There is a high disability recipient rate, …

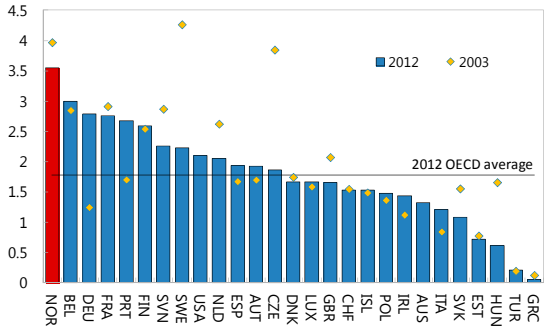
Disability Benefit Recipiency Rates
(Percent of population aged 20-64)



Sources: OECD and Fund staff calculations.

…as well as large sickness absence incidence, …

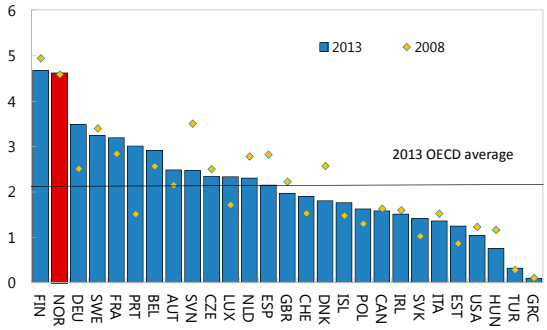
Sickness Absence
(Incidence of sickness absence of employees)



Sources: OECD and Fund staff calculations.

…resulting in waste of manpower resources.

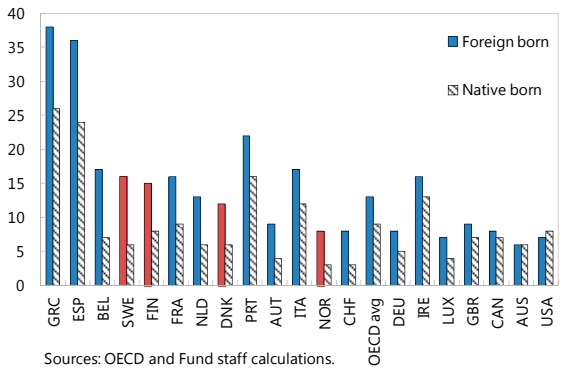
Number of Weeks Lost Due to Sick Leaves



Sources: OECD and Fund staff calculations.

6. A surge in immigrants into Norway over the past decade has also added new dimensions to the Norwegian labor market. There has been a long tradition of regional labor mobility across Nordic countries since the implementation of the common Nordic labor market in the 1950s. There have been steady immigration inflows from other OECD countries as well. More recently, Norway has seen a sharp increase in immigration from non-Western countries, most notably from new EU member states. On one hand, immigration can help relieve short-term overheating pressures on the economy by expanding the labor supply, as well as address longer-term issues arising from population aging. On the other, there are implications for public finance and the welfare state. Immigrants from non-Western countries are likely to have different

Unemployment Rate of Foreign and Native-Born, 2013
(Percent; in descending order of foreign-native differential)



Sources: OECD and Fund staff calculations.

education backgrounds and qualifications compared with workers from the Nordic neighbors or advanced OECD countries. Non-Western immigrants are more likely to face skills mismatch and only a minority of them will be job-ready on arrival. As a result, these immigrants are more likely to be unemployed—there are large differences between the unemployment rates of the native-born and the foreign-born population in the Nordics—and receive social insurance benefits. The following section examines the recent trend of immigration flows into Norway and labor market implications.

B. Perspectives on Immigration in Norway

Stylized facts and drivers

7. The Nordic countries, particularly Norway, are seeing an increasing presence of foreign population (Figure 4). Although the stock of immigrants in the Nordics is still relatively low compared to several other advanced OECD countries, net migration inflows as a share of population have picked up significantly since the mid-2000s—with only a brief interruption during the global financial crisis. Norway has experienced the largest wave of immigration in the Nordic region—supported by robust oil prices and economic growth, followed by Sweden and Denmark, surpassing the median OECD country.

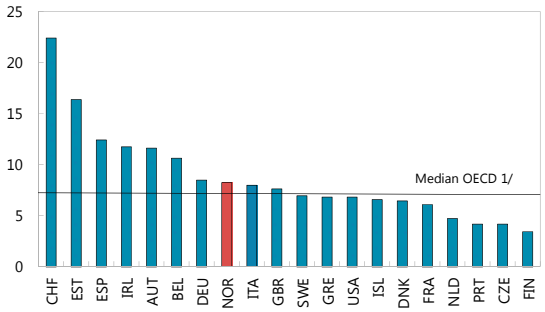
8. The recent wave of new comers is changing the composition of Norway's immigrant population. Prior to 2004, Norway's foreign population was dominated by Nordic/Western immigrants and refugees/asylum seekers from non-Western countries. Work-related admission was rather restricted and available only through the `specialist' or `seasonal worker' programs, which required that the immigrant already had a job offer in hand (see e.g. Bratsberg and others, 2014a). The EU enlargements in 2004 and 2007 opened the Norwegian labor market to accession countries due to Norway's European Economic Area (EEA) membership, and triggered a surge of labor immigrants from the new EU member states, particularly Poland and Lithuania. Meanwhile, intra-Nordic labor movement as a whole has been stable thanks to the long-standing Nordic common labor market. Nevertheless, bilateral intra-Nordic migration exhibits pronounced cyclical patterns (Figure 4), suggesting that Nordic workers tend to move to the country in the region where economic conditions and hence job opportunities are relatively more favorable.

9. The educational composition of the immigrant population has also shifted. In 2000, immigrants to Norway consisted mainly of those with `medium' educational attainment—defined as levels 3 and 4 according to the International Standard Classification of Education (ISCED). By 2010, the shares of immigrants with `low' (ISCED 0/1/2) and `high' (ISCED 5/6) levels of education have increased (Figure 4), suggesting that the incoming migration population into Norway has become more heterogeneous in terms of skill levels. Immigrants from non-OECD countries are on average lower-skilled, whereas OECD and Nordic migrants have higher and similar skill levels. Among the Nordic countries, Norway and Denmark seem to be able to attract relatively higher shares of highly-educated immigrants, whereas Sweden's immigrant population is dominated by the medium-skilled, and Finland by the lower-skilled.

Figure 4. Characteristics of Immigration to Norway

Although the stock of immigrants remains low, …

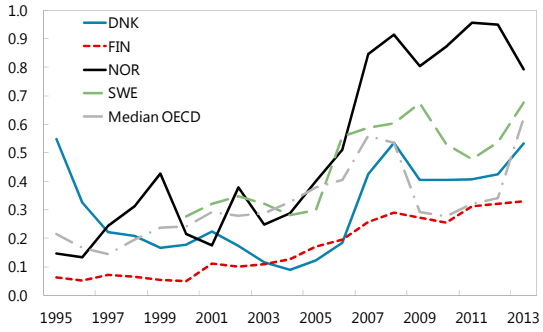
Stock of Foreign Population, 2011
(Percent of population)



Sources: OECD and Fund staff calculations.
1/ Advanced OECD, excluding Luxembourg.

…net migration flows to Nordic region have increased.

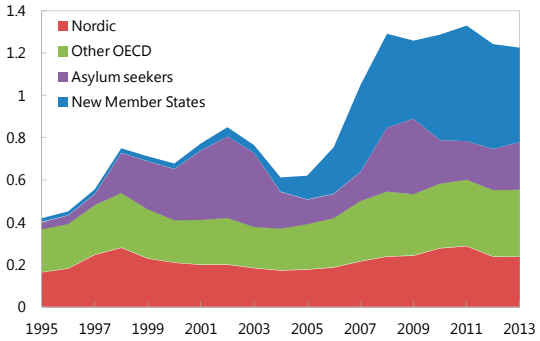
Net Migration Flows
(Percent of population)



Sources: National Statistical Offices and Fund staff calculations.

In Norway, it's driven by migrants from New Member States.

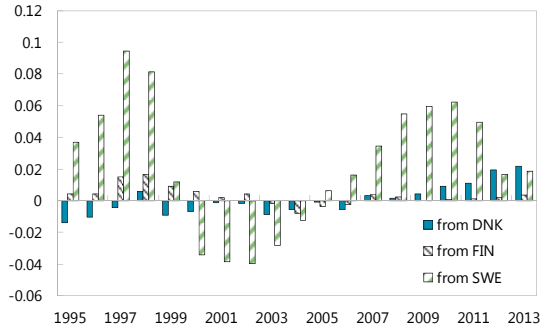
Norway: Migration Inflows by Source
(Percent of population)



Sources: National Statistical Offices and Fund staff calculations.

Intra-Nordic labor movement is cyclical.

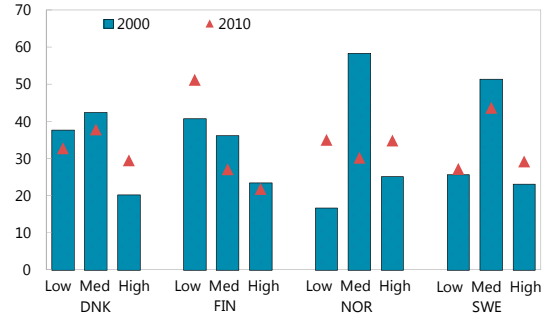
Norway: Intra-Nordic Bilateral Net Migration Flows
(Percent of population)



Sources: National Statistical Offices and Fund staff calculations.

Norway is receiving more low- and high-skilled migrants.

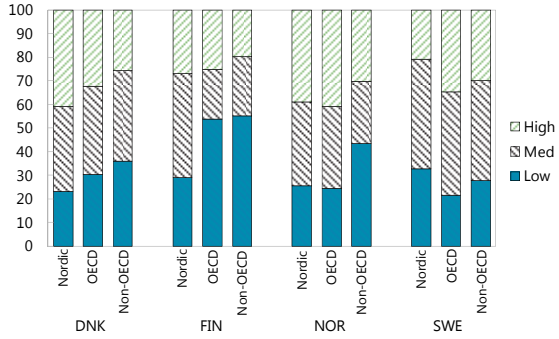
Immigrant Stock by Educational Attainment
(Percent of total)



Sources: OECD and Fund staff calculations.

Non-OECD migrants are lower-skilled than Nordic/OECD.

Immigrant Stock by Source and Education, 2010
(Percent of total)



Sources: OECD and Fund staff calculations.

10. Econometric analysis helps explain the forces shaping bilateral migration flows to the Nordic region. The economic determinants of both intra-Nordic labor movements and immigration from non-Nordic sources are examined using a panel regression framework that allows for both "push" and "pull" effects.[5] Factors considered include, among others, differences between host and source countries in economic and labor market conditions, the existing immigrant stock to capture "network" effects, and attractiveness of the benefit system in the host country.[6, 7] The model is estimated using data on bilateral net migration flows to the four Nordic countries during 1995–2012.

Table 1. Drivers of Net Migration Flows to Nordic Countries

Variables	(1) Intra-Nordic	(2) OECD/EU	(3) OECD/EU
Stock of immigrants (% of population, lag)	-0.0261	0.1586	0.1614
	[0.017]	[0.006]***	[0.005]***
GDP growth differential (host-source, lag)	0.0022	0.0003	0.0002
	[0.001]**	[0.000]**	[0.000]*
Log real wage differential (host-source, lag)	0.1310	0.0320	0.0217
	[0.041]***	[0.005]***	[0.005]***
Unemployment rate differential (host-source, lag)	-0.0036	-0.0005	-0.0002
	[0.001]***	[0.000]***	[0.000]
Share of 15-29 population in source country (%, lag)	0.1719	0.0217	0.0151
	[0.053]***	[0.006]***	[0.006]**
Employment protection in host country		0.0054	0.0056
		[0.004]	[0.004]
Unemployment benefit replacement rate in host country		0.0144	0.0151
		[0.004]***	[0.004]***
EU membership for NMS (dummy)		0.0124	0.0043
		[0.001]***	[0.002]**
Unemployment differential*EU membership			-0.0014
			[0.0002]***
Observations	100	1,364	1,364
R-squared	0.454	0.509	0.528
Number of country pairs	6	104	104

Source: Fund staff estimates.
Note: Dependent variable is bilateral net migration flows to each Nordic country. Panel regressions with a full set of country pair and year fixed effects. Robust standard errors in brackets. Statistical significance at 1% ***, 5% **, and 10% *.

11. Results support the push–pull hypothesis (Table 1). Consider first intra-Nordic migration. A large part of labor movements within the Nordic region can be explained by the relative business cycle positions across the countries: countries tend to attract more Nordic workers at times of higher GDP growth and real wages and lower unemployment. For example, a one standard deviation

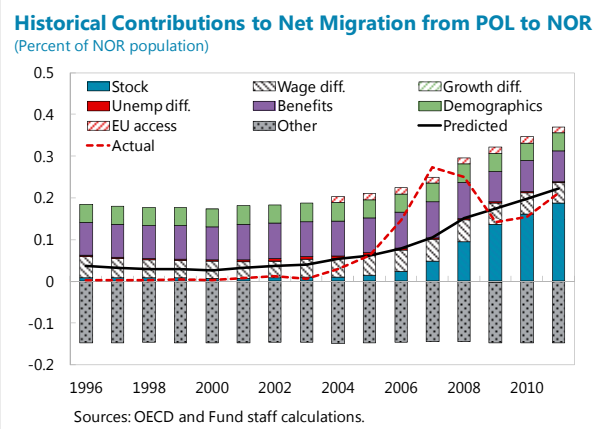
[5] For more detail, see Ho and Shirono (*forthcoming).*

[6] EU rules on social security coordination ensure that entitlements are transferred to the country of employment. This means that, for example, Eastern European labor immigrants to the Nordic countries immediately gain access to the same welfare transfers and insurance programs as natives. See e.g. Bratsberg and others (2014b).

[7] Time-invariant bilateral migration costs such as linguistic/colonial links and geographical distance are captured by country pair fixed effects, and common shocks by year fixed effects.

increase in the unemployment rate in Sweden relative to Norway would trigger a 0.01 percentage point—or 1½ standard deviation—reduction in the net migration rate from Norway to Sweden. Similarly, availability of economic opportunities in the Nordic countries also plays a crucial role in attracting migration flows from outside the region; however, the magnitude of the elasticities is smaller than for intra-Nordic migration. In contrast to the intra-Nordic results, there is a strong network effect: immigrants from outside the region tend to "follow" each other. In addition, they respond to the generous unemployment insurance regime in the Nordic countries. The free labor mobility that comes with EU membership has also facilitated migration flows, and made migration flows even more sensitive to differences in cyclical conditions.

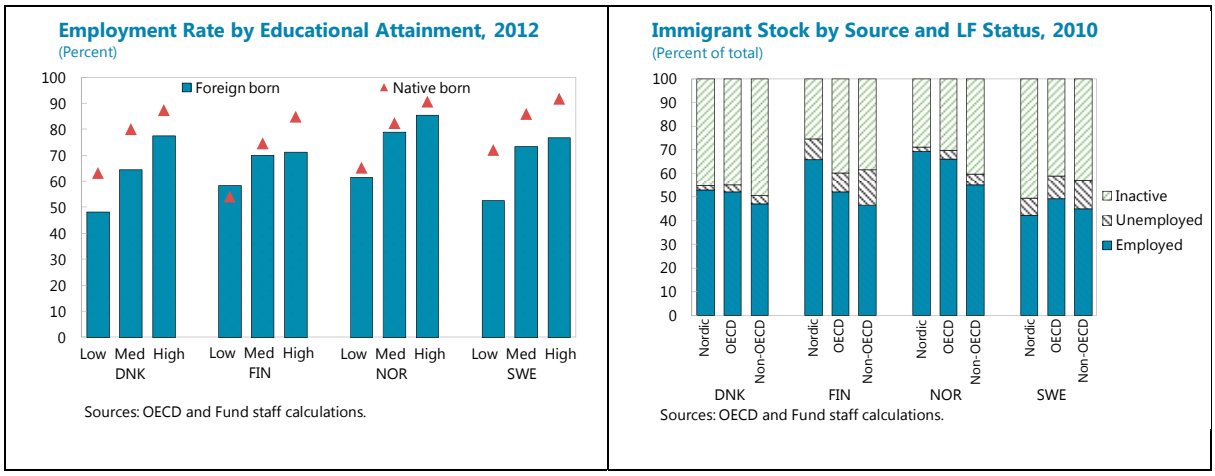
12. The framework explains migration patterns for workers from Nordic and advanced OECD countries well, but it works less well for migration from the new member states. For Polish workers in Norway, the model indicates that the large real wage differential, demographic factors, and attractive Norwegian unemployment benefits have always been important, but that the surge in immigration flows after 2004, when Poland joined the EU, is mainly driven by increasingly stronger network effects (the fact that the rising Polish immigrant population in Norway encourages more Poles to migrate) and EU membership. However, the surge predicted by the model still falls short of that observed in the data, and cyclical differences do not seem to explain the crisis-related reduction in net migration flows from Poland during 2008–09.[8]



Labor market outcomes

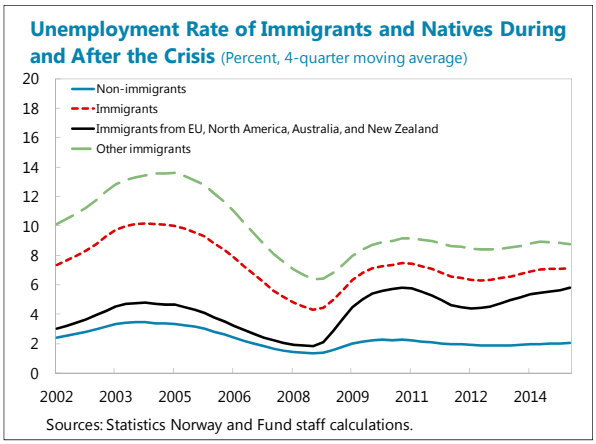
13. Immigrants to the Nordic countries have generally experienced less favorable labor market outcomes compared to natives. Unemployment rates among the foreign-born population are higher, and employment and participation rates lower, relative to the native-born. While the foreign-native employment rate gaps are smaller for Norway and similar across the skill spectrum (as measured by educational attainment), the gaps are more pronounced for Sweden and Denmark. Immigrants from non-OECD countries often experience lower employment rates and higher unemployment rates than their Nordic and OECD peers.

[8] This suggests the inclusion of a more targeted variable that better captures the cyclical employment conditions of these immigrants (e.g., performance of the construction sector, which employs a disproportionately large share of lower-skilled immigrants).



14. A recent 2010 survey conducted in Oslo and other Nordic cities looked at the labor market profile of labor immigrants from Central and Eastern Europe, particularly Poland.[9] It shows that Polish migrants to the Nordics are often young; most have limited local language ability[10]; and the majority are `medium-skilled', i.e. having secondary education with vocational training or technical college (although vocational credentials acquired in Poland are often not recognized in the Nordics). The vast majority of Polish migrants in Oslo take jobs in construction and cleaning services; there is a heavy concentration of Polish males in construction (85%) and Polish females in cleaning services (76%). As a result of the large concentration of new member states' labor migrants in these sectors (also agriculture and ship building), Norway has imposed the mandatory extension of the minimum wages provisions of the collective agreements to these sectors.

15. The crisis has put labor migrant adjustments and Norway's generous welfare system to the test. The recent cohort of Eastern European labor migrants in Norway were initially not dependent on social insurance transfers and received no transfers at all during the first years after arrival (Bratsberg and others, 2014a). However, the financial crisis hit these immigrants particularly hard, partly owing to their concentration in the highly cyclical construction industry. As a result, unemployment benefit claims among this group of immigrants rose markedly during 2008–09, and some decided to return to their home country. The propensity to out-migrate in response to an adverse earning shock is found to be substantially



[9] See Nordic Council (2013).

[10] While refugees in Norway have a right and duty to language training and other integration programs, labor migrants from within the EU generally do not.

higher among those ineligible for unemployment insurance (Bratsberg and others, 2014b). Thus, there is a tension between providing social insurance and facilitating labor supply adjustment in response to a negative shock. In the case of Norway, the generous unemployment insurance regime contributed to a higher immigrant unemployment rate during and after the crisis. The recent decline in oil prices has contributed to slowing net immigration inflows and unemployment has edged up, but it remains to be seen to what extent labor supply from immigrants will adjust to the new, more difficult economic condition. More flexible labor supply adjustment would help relieve pressure on the unemployment benefit system. In terms of health-related benefits, while the recent labor immigrants from Eastern Europe have not made it onto the disability insurance rolls, micro data show a steady rise over time in the disability program participation rate among earlier cohorts of refugees and labor migrants (Bratsberg and others, 2014a).

16. More generally, labor market institutions play an important role in determining immigrants' labor market outcomes. Effective integration programs (e.g., language and vocational training, creating the right incentives from social benefits) can help support the transition of newly-arrived immigrants to fruitful labor market participation. The Nordic countries have had integration programs since the early years, but these are usually more geared toward supporting the asylum seekers and their families. Existing labor market institutions also matter. For example, active labor market policies (ALMP)—a prominent feature of the Nordic labor market model—can greatly benefit immigrants and their children, who are often overly represented among the lower-skilled segment of the workforce. On the other hand, the wage compression resulting from high collectively-bargained minimum wages could hurt immigrants' job finding prospects by creating the need to subsidize the wage-productivity differential to maintain employment.

17. Empirical evidence from a sample of 28 OECD countries over 2001-12 supports the importance of labor market institutions (Table 2). In particular, boosting ALMP spending per

Table 2. Explaining Foreign-Native Unemployment Gaps

VARIABLE	Coef.	Std. Err.
Output gap	-0.12	0.06**
Total immigrant inflows (lag)	0.65	0.63
Asylum seeker inflows (lag)	6.30	2.45**
ALMP spending per unemployed (lag)	-0.08	0.02***
Ratio 90th to 10th percentile wage (lag)	-3.83	1.1***
Unemployment benefit replacement rate (lag)	0.01	0.03
Constant	16.70	3.73***
Observations	195	
R-squared	0.21	
Fixed effects	Y	

Source: Fund staff estimates.
Note: Dependent variable is foreign-native unemployment rate gap. Estimated with panel fixed effects estimator on a sample of 28 OECD countries over 2001-12. Statistical significance at ** 5% and *** 1%.

unemployed is associated with a lower gap between foreign-born and native-born unemployment rates. Reducing wage compression also helps significantly. As an illustrative example, other things constant, increasing the $90^{th}/10^{th}$ percentile wage ratio from Norway's level (2.4) to OECD average (3.4) is estimated to narrow the Norwegian unemployment gap by 3.8 percentage points—or about three quarters of the observed gap in 2013.

C. Conclusion

18. Labor market outcomes have been rather robust in Norway, but there are also challenges. Dependency on sick leave and disability benefits continues to be high, which could be seen as "disguised" unemployment. A surge in non-Western labor immigrants in recent years, particularly from new EU member states, has created new challenges, including potential increase in welfare costs in the case of economic downturns and employment gap between native-born and foreign born workers. These issues are also intertwined with labor market institutions in Norway. For example, the compressed wage structure tends to generate a wage-productivity differential, which is likely to prevent some groups of people (e.g., low-skilled Norwegian youth or newly arrived immigrants) from entering the labor market if the incentive to work is not well balanced against social safety net.

19. Some reforms and initiatives have been implemented to address these labor market issues in Norway.

- The Inclusive Workplace Agreement (IA) was signed in 2001 between the government and the social partners to reduce sickness absence and increase the employment of disabled people. Despite the limited success of the agreement, it has been renewed many times.
- In 2011, reforms were introduced to enable closer monitoring of sick leave with the aim of facilitating a more rapid return to work.
- The 2011 pension reforms introduced an adjustment of pensions for changes in life expectancy, flexible retirement starting at age 62 based on actuarial principles, and new rules for indexation of pensions. The full impact of reforms is yet to be known, but preliminary data suggest some increase in labor participation in older workers.
- Starting from January 2015, the disability pension was replaced with disability benefits. All disability pensions are now recalculated as disability benefits which are taxed as wage income and not as tax-preferred pensions. The new system aims to create incentives to work while receiving disability benefits.
- Collective bargaining has also evolved over time to take account of new aspects of employment conditions in response to a growing number of immigrants. For example, there is now mandatory extension the minimum wages provisions of collective agreements to certain sectors where labor migrants are more concentrated, including construction.

20. Further reforms to sickness and disability benefits will be crucial to prevent people from dropping out of the labor market. Such reforms would help maintain the participation rate in the face of an aging population. At the same time, reforms would help to prevent potential dependency on these benefits among immigrants in the future.

21. Greater wage variation could also facilitate the adjustment towards a new growth model. Wage formation may need to allow for greater differentiation in compensation across sectors to better align wage developments with productivity in the private sector, especially if the transition costs in terms of lower growth and higher unemployment turn out to be greater than anticipated.

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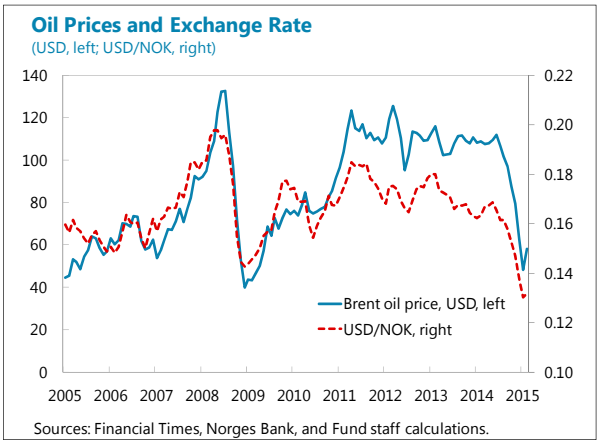
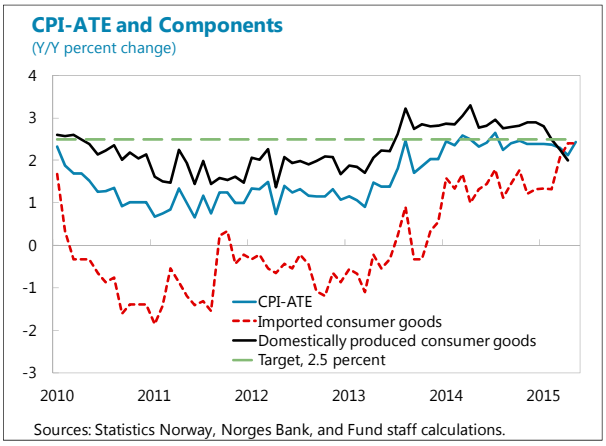
EXCHANGE RATE PASS-THROUGH AND INFLATION DYNAMICS IN NORWAY[1]

The recent decline in oil prices has introduced interesting dynamics to Norwegian inflation. On one hand, lower oil prices put a brake on mainland growth momentum, which is dependent on demand from the off-shore oil and gas sector. On the other, the significant depreciation of the Norwegian krone that accompanies low oil prices may lead to inflationary pressures. This note examines to what extent exchange rate depreciation is passed through to imported and overall consumer prices in Norway, and builds a simple Phillips curve-based model for forecasting inflation that incorporates the role of the exchange rate.

A. Exchange Rate Pass-Through

1. Understanding exchange rate pass-through (ERPT) is important for monetary policy. Measured by the import-weighted nominal effective exchange rate, Norway's exchange rate has depreciated by over 10 percent between June 2014 and March 2015, largely owing to the expectation that falling oil prices will adversely affect the oil- and gas-dependent mainland economy. The Norges Bank's recent Monetary Policy Reports cited the weakening growth outlook and krone depreciation as two opposing forces driving inflation. Going forward, monetary policy decisions will need to weigh the relative importance of these two factors, among others, in determining the appropriate interest rate path. In doing so, it would be helpful to gauge the potential magnitude and timing of the impact of exchange rate depreciation on imported and overall consumer price inflation.





2. Recent currency weakness has pushed up imported inflation, but had limited impact on overall inflation so far. Imported consumer goods recorded stronger price growth in early 2015; however, inflation in domestically-produced consumer goods has been edging down, keeping overall CPI-ATE inflation close to the target.

[1] Prepared by Giang Ho.

Moderating wage growth likely contributes to limiting the spillovers from imported inflation to domestic inflation.

3. Recent research found limited evidence of exchange rate pass-through for Norway. For example, Holm (2014), using quarterly data between 1996Q1 and 2013Q4, found a small effect of the exchange rate on imported consumer goods prices, and that ERPT seems to be non-linear: substantial changes in the krone exchange rate tend to have more pronounced effects than small variations. The study did not find strong evidence that pass-through is asymmetric between appreciation and depreciation episodes.

4. We estimate the degree of ERPT for Norway in a Vector Auto-Regression (VAR) framework. Exchange rate movements are assumed to affect consumer prices primarily through two channels: (i) a direct effect on the prices for imported consumer goods—which account for about 30 percent of the consumer price index in Norway; and (ii) an indirect effect via prices for imported intermediate goods, which in turn influence prices for domestically produced goods and services by increasing the costs of imported inputs. Thus, the model bears a resemblance to that in An and Wang (2011) and the related strand of literature on the "distribution chain of pricing." In addition to the main variables—the nominal effective exchange rate, imported consumer prices, producer prices, and consumer prices, the model also includes an index of commodity prices, a short-term interest rate, and a measure of aggregate demand (i.e., industrial production) to allow commodity price shocks, monetary policy, and macroeconomic conditions to influence the pass-through relationship.[2] The VAR is estimated using monthly data over January 2000–March 2015, and a Cholesky decomposition of the variance-covariance matrix is used to identify the structural shocks.[3]

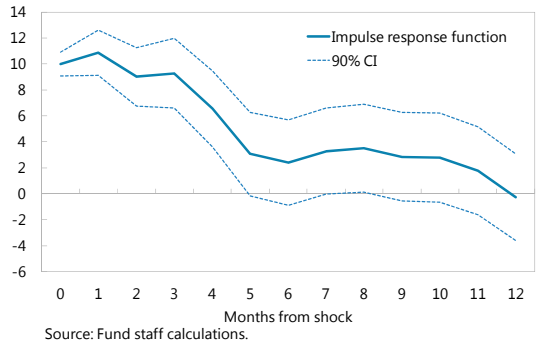
5. Results indicate that the average pass-through from exchange rate to consumer prices is incomplete and small (Figure 1). In response to a 10 percent nominal exchange rate depreciation, over 80 percent of the exchange rate shock is immediately passed through to producer prices in the mining, quarrying, manufacturing and electricity industries. However, only about 10–15 percent is eventually passed on to overall consumer prices. The impact on consumer prices is also relatively short-lived, lasting about three months on average. By contrast, the exchange rate impact on imported consumer prices tends to be more delayed but more persistent, reaching about 20 percent cumulative pass-through by the end of the 12th month.

[2] All variables enter the model as year-on-year growth rates, except for the short-term interest rate. Four lags are included.

[3] The Cholesky identification scheme assumes the following order of the variables: ($\Delta pcom$, sr, Δip, $\Delta neer$, $\Delta pimp$, Δppi, Δcpi).

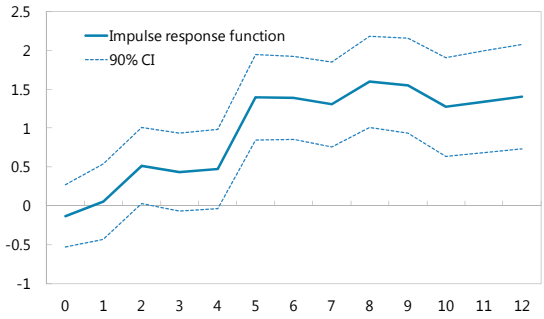
Figure 1. Estimated Price Responses to An Exchange Rate Shock

Shock to Nominal Exchange Rate
(Percent, deviation from baseline)



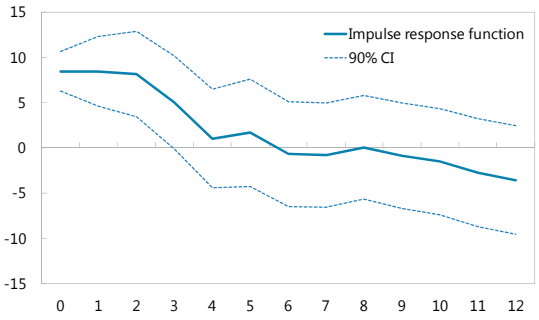
Source: Fund staff calculations.
Note: A positive number indicates depreciation.

Response of Imported Consumer Prices
(Percent, deviation from baseline)



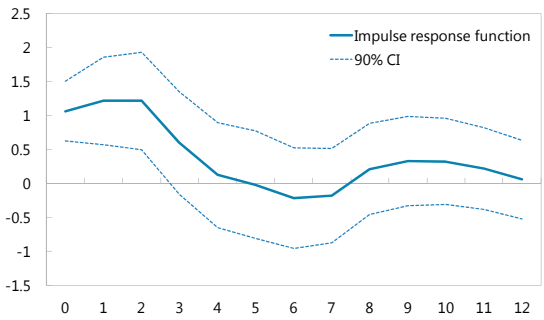
Source: Fund staff calculations.

Response of Producer Prices
(Percent, deviation from baseline)



Source: Fund staff calculations.

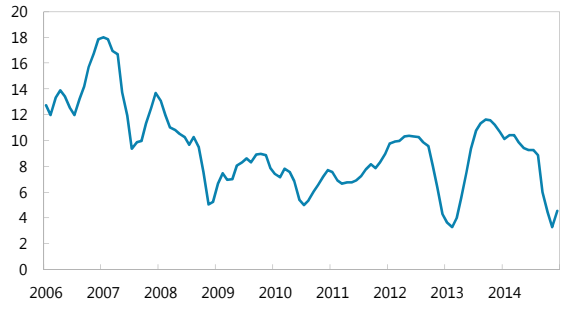
Response of Consumer Prices
(Percent, deviation from baseline)



Source: Fund staff calculations.

6. There is also evidence that pass-through has declined over time. Based on rolling regressions using overlapping samples of 6-year length, pass-through to consumer prices is estimated to be on a declining trend since the early 2000s. For example, the 3-month cumulative pass-through based on data from the first half of the 2000s averages about 15 percent, compared to 9 percent average for the most recent period. This is not a recent phenomenon, however. A number of studies have found empirical evidence of declining pass-through in both industrial and developing countries during earlier periods (e.g., Campa and Goldberg, 2002; Gagnon and Ihrig, 2004).

Declining Exchange Rate Pass-Through to Consumer Prices
(Percent, 3-month moving average)



Source: Fund staff calculations.
Note: 3-month cumulative pass-through estimated from rolling regressions using overlapping 6-year samples (x-axis denotes end of sample).

7. Norway's low degree of ERPT is consistent with a low inflation environment and credible monetary policy. A firm setting prices for the period ahead would be less likely to pass on exchange rate movements to consumers if it does not expect the increase in costs to be persistent–that is if inflation is low and stable and inflation expectations are well-anchored. This is Taylor's (2000) hypothesis, which links the level of inflation to the degree of ERPT and which has enjoyed strong empirical support in cross-country analyses. Norway's low and stable inflation environment, supported by the credible inflation targeting regime, likely contributes to limiting exchange rate pass-through, even during large depreciation episodes.

B. A Model for Forecasting Inflation

8. We build a simple model of Norwegian inflation dynamics. The goal is to have a simple framework to weigh the relative importance of recent forces driving inflation in Norway, namely the weakening growth outlook and exchange rate depreciation. The latter may have a small impact on consumer price inflation, as the analysis in the previous section shows, but its role cannot be ignored. Our model is essentially an augmented Phillips curve that explicitly incorporates supply-side factors, following the spirit of the "triangle model" (see e.g. Gordon, 2013).[4] It includes a lagged term of inflation—this could capture adaptive inflation expectations, the (mainland) output gap, the real effective exchange rate (REER) gap—defined as deviation of REER from its "fundamental" or trend values, and the productivity gap—defined similarly.[5]

$$\pi_t = \alpha + \beta\pi t - 1 \quad + \gamma\hat{y_t} + \delta\hat{xr_t} + \theta\hat{p_t} + \varepsilon_t$$

In an alternative specification, the exchange rate variable is replaced with imported price inflation and/or changes in a commodity price index. The model is used to explain either headline or core inflation (i.e. CPI excluding effects of taxes and energy).[6] It is estimated using Generalized Method of Moments (GMM) on quarterly data over 1996Q1–2015Q1, with lagged inflation and the output gap instrumented using lags of the short-term interest rate.

9. The model—although simple—explains Norwegian inflation reasonably well (Table 1). Headline inflation is fairly persistent with an autoregressive coefficient of 0.47. Demand pressures exert significant effects on inflation: a one percentage point increase in the output gap raises headline inflation by over 25 basis points. A real exchange rate depreciation (relative to trend) raises inflation, but the degree of pass-through is small (about 7 percent)—consistent with findings from the previous section. And finally, a productivity acceleration helps reduce inflation (consistent with rigid wages). The baseline model explains about half of the variation in Norway's quarterly headline inflation (column 1), and over 90 percent in core inflation (column 4). In alternative specifications, an

[4] The triangle model refers to a Phillips Curve that depends on three elements—inertia (e.g., adaptive expectations), demand (e.g., unemployment or output gap), and supply (e.g., food and energy prices, exchange rate, productivity growth). Supply shock variables appear explicitly in the inflation equation rather than being forced into the error term as in the New Keynesian Phillips Curve approach.

[5] The "gap" variables are measured as deviations from an HP trend.

[6] We are grateful to the Norges Bank for providing historical series for CPI-ATE.

increase in the price of imported consumer goods has similar effects as does an exchange rate depreciation (column 2), whereas a commodity price shock has little discernible impact on inflation (column 3), with Norway being an oil exporter. Any impact of the oil price on inflation would likely work through its effect on the output gap.

Table 1. A Phillips Curve Model of Inflation

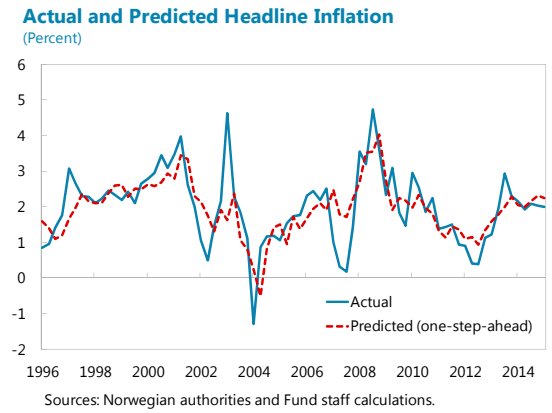
	Headline inflation			Core inflation
	(1)	(2)	(3)	(4)
Lagged inflation	0.47	0.71	0.74	0.77
	(0.24)*	(0.23)***	(0.18)***	(0.10)***
Output gap (lag)	0.27	0.31	0.28	0.15
	(0.12)**	(0.15)**	(0.14)**	(0.04)***
REER gap (lag)	-0.07			-0.02
	(0.03)**			(0.01)**
Productivity gap (lag)	-0.15	-0.06	-0.09	-0.08
	(0.09)*	(0.09)	(0.09)	(0.04)*
Imported consumer goods inflation		0.24	0.25	
		(0.11)**	(0.11)**	
Imported consumer goods inflation (lag)		-0.24	-0.2	
		(0.13)*	(0.13)	
Commodity price inflation (lag)			0.006	
			(0.004)	
R-squared	0.49	0.42	0.46	0.91
Number of observations	79	79	79	68

Source: Fund staff estimates.

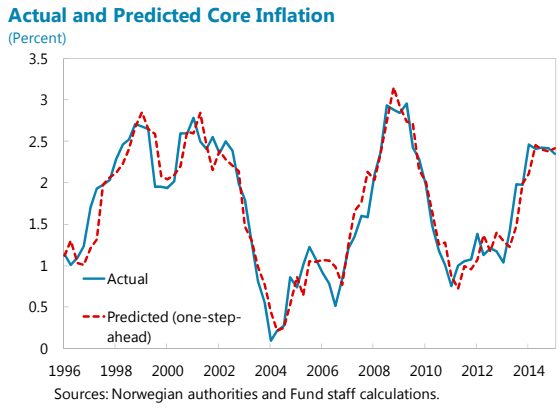
Note: Estimated with GMM; lagged inflation and output gap instrumented with lags (second to fifth) of the short-term interest rate. Quarterly data 1996Q1-2015Q1. Robust standard errors in parentheses. Significant levels 1% ***, 5% **, 10% *.

10. In-sample and out-of-sample forecasting performance is good (Figure 2). The one-step-ahead forecast of core inflation closely follows the actual. Forecasts of headline inflation are reasonable, although the model cannot explain several upward and downward spikes in inflation (e.g., those caused by a VAT reduction in 2001Q1 as well as electricity price changes in the first half of 2003). Focusing on core inflation to rule out price movements resulting from one-off changes in taxes or energy prices, we also examine the model's 16-step-ahead forecast starting in 2011Q1. The central core inflation path predicted by the model is reasonably close to the actual path, with actual inflation staying inside the 95 percent confidence band in the majority of quarters.

Figure 2. Forecast Evaluation



Sources: Norwegian authorities and Fund staff calculations.



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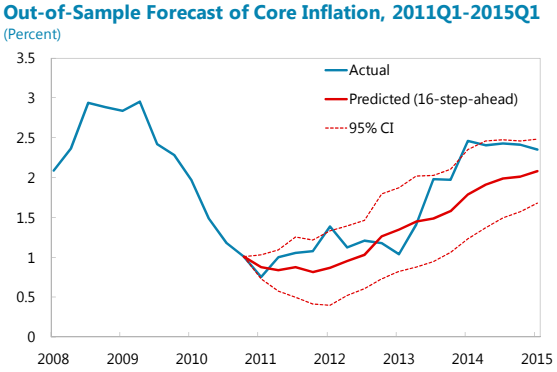
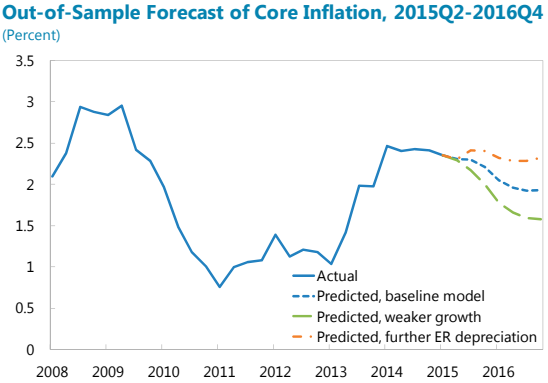


Sources: Norwegian authorities and Fund staff calculations.



Sources: Norwegian authorities and Fund staff calculations.

11. The model can be used to examine forecast scenarios in the period ahead. We perform dynamic forecasts of core inflation from 2015Q2 to 2016Q4. In the baseline scenario, which features a moderate slowdown in mainland growth and a gradual rebounding of the real krone exchange rate,[7] core inflation is predicted to stay rather subdued at less than the 2½ percent target during the next two years. Core inflation would be even more subdued should growth turn out to be weaker than expected.[8] However, in a scenario of further and persistent exchange rate depreciation,[9] core inflation would be significantly stronger and closer to the target despite limited exchange rate pass-through.

[7] For the dynamic forecast, we use the WEO projection of the output gap, and project the REER and productivity gaps using an ARIMA model.

[8] In this scenario, the (negative) output gap is wider by 0.75 percentage points relative to baseline in each quarter during the forecasting period.

[9] This scenario assumes that the real exchange rate depreciates by an additional 5 percent in each quarter relative to baseline.

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