STAFF MEMO

What influences household demand for goods and services?

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What influences household demand for goods and services?

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Summary

Norwegian household consumption has been weak since the financial crisis, both in a historical context and compared with other countries. The estimations over the period 1994-2015 indicate that since the financial crisis consumption has been restrained by more limited access to credit and greater uncertainty surrounding economic developments. In addition, other estimations indicate that demographic changes and the pension reform in 2011 have dragged down consumption. Those structural changes are likely to have a lasting negative effect on consumption, while the uncertainty effect is more temporary. If consumer confidence, uncertainty and access to credit return to their historical averages, consumption may over a period grow faster than household disposable income. Our estimations indicate that consumption will account for between 90 percent and 95 percent of disposable income in a long-term equilibrium. The share was a little higher than 90 percent in 2015.

[1] We would like to thank André K. Anundsen, Solveig Erlandsen, Kjersti Haugland, Per Espen Lilleås, Kjersti-Gro Lindquist, Ingrid Solberg and other colleagues at Norges Bank for useful input and comments. We have also benefited greatly from the seminar held by Eilev S. Jansen at Norges Bank on 27 October 2015.

Contents

1. Introduction

Household consumption accounts for over half of mainland demand in Norway. Consumption growth has been weak since the financial crisis. Measured as a share of disposable income (consumption ratio), consumption has declined by more than 4 percentage points since 2009. Developments have been weak in a historical context and compared with other countries. In recent years, it has also been lower than traditional models can explain.

For monetary policy it is important to understand the driving forces behind developments in consumption. If changes are due to structural conditions, such as demographic changes, the equilibrium level for the consumption ratio will change. If changes are due to cyclical conditions, the effect will be more temporary.

In this article, we analyse the main driving forces behind developments in household consumption in Norway. We estimate a model that combines insight from traditional models with newer theories. The model includes fundamental variables such as household disposable income, wealth and the interest rate level. In addition, we have looked at the effects of access to credit, uncertainty surrounding economic developments and house prices. According to the model, consumption after the financial crisis has been restrained by limited access to credit, lower consumer confidence and greater uncertainty surrounding economic developments, while the interest rate decline has underpinned consumption.

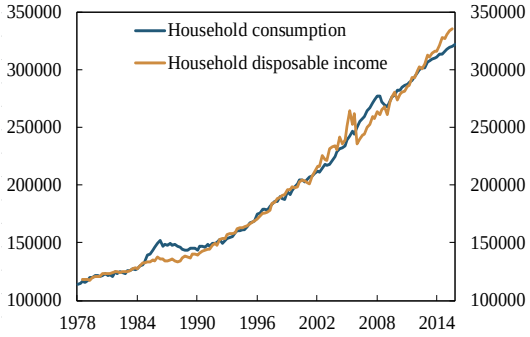
These explanatory factors generally vary with the business cycle. The model will therefore have difficulty explaining changes in consumption due to structural changes. Simple estimations that are made outside the model show that structural changes after the financial crisis, such as the pension reform in 2011 and demographic changes, have likely also weighed on consumption. These conditions will probably have a lasting negative effect on consumption.

Model estimations indicate that consumption over a period may grow faster than household purchasing power if uncertainty and access to credit return to their historical average. In the model's estimation period, the average consumption ratio is just below 95 percent. In 2015, the ratio was slightly higher than 90 percent. Our estimations indicate that the long-term equilibrium level may have fallen to between 90 percent and 95 percent as a result of more permanent driving forces. This is consistent with historical averages for other countries. The consumption ratio may thus increase by 1-2 percentage points from today's level when cyclical conditions normalise.

2. Historical developments

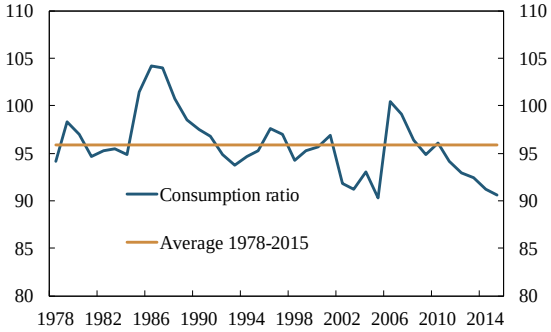
In the past decades, there has been a close relationship between consumption and household disposable income (Chart 1). Since the financial crisis in 2008-2009, however, consumption growth has been lower than income growth, and the consumption ratio has declined (Chart 2).

Chart 1. Household consumption[1)] and disposable income[2)]. Constant prices. Seasonally adjusted. In millions of NOK. Percent. 1978 Q1– 2015 Q4



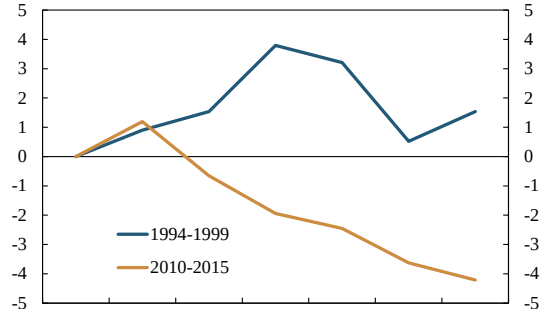
1) Includes consumption for non–profit organisations
Source: Statistics Norway

Chart 2. Household consumption as a share of disposable income[1)]. Percent. 1978 – 2015



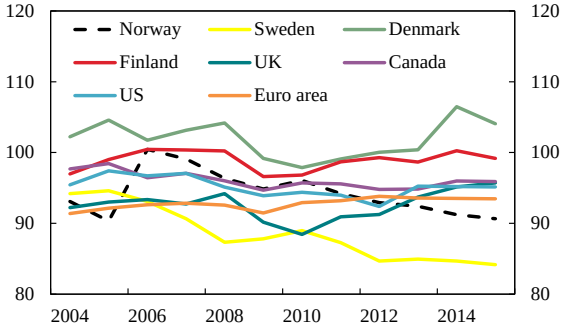
1) Disposable income adjusted for household pension funds
Source: Statistics Norway

Chart 3. Household consumption as a share of disposable income[1)]. Change over two six-year periods. Percentage points



1) Disposable income adjusted for household pension funds
Source: Statistics Norway

Chart 4. Household consumption. Share of disposable income[1)]. Constant prices. Percent. Annual figures. 2004-2015[2)]



1) Disposable income adjusted for household pension funds
2) For some countries, figures for 2015 are OECD projections
Sources: Statistics Norway and OECD

Developments have been weaker than in the years following the banking crisis (Chart 3). The consumption ratio edged up in the first year following both crises[2], but declined in the next five years following the financial crisis. The overall decline over the past six years is 4 percentage points. By comparison, the ratio increased by more than 1 percentage point between 1993 and 1999.

Since 2009, the consumption ratio has also been weaker in Norway than in many other countries (Chart 4). Of the countries in the chart, only Sweden has seen a comparable fall. The consumption ratio for Norway is higher than for Sweden, but more than 2 percentage points lower than the average for the euro area in 2014 and distinctly lower than for Denmark, Finland, the UK, Canada and the US. This likely reflects the low level of household saving in Norway in the years prior to the financial crisis.[3]

[2] We use the same dating of the crises as Dahl et al. (2011). According to that dating, the banking crisis lasted from 1988 Q2 to 1993 Q3, while the financial crisis lasted from 2008 Q3 to 2009 Q3.
[3] Some of the increase in the saving ratio in 2006 reflects households' adaptation to new tax rules in 2005, entailing an increase in dividend income. In 2006, a dividend and capital gains tax on equity income was introduced on income in excess of risk-free interest. This led to tax-motivated transactions in the preceding years. The high share dividends influenced growth in disposable income during this period.

3. Theory and literature

The first literature on aggregate consumption was published in the interwar years (Fisher, 1930; Keynes, 1936 and Ramsey, 1928). In 1936, Keynes developed the absolute income hypothesis, which asserts that households consume a fixed share of their income at all times.

Two decades later, the life-cycle and permanent income hypotheses were introduced (Modigliani and Brumberg, 1954 and Friedman 1957). The hypotheses assert that households prefer relatively stable consumption over a lifetime. The permanent income hypothesis asserts that consumption choices are determined by the present value of permanent income[4], while variations in current income have little impact. If current income is higher than permanent income, the difference is saved. If current income is lower than permanent income, households raise debt to increase consumption pending future income growth.

The life-cycle hypothesis posits that younger households raise debt to increase consumption pending future income growth. The middle-aged with relatively high income save for retirement, while pensioners finance consumption with savings (Modigliani and Brumberg, 1954 and Ando and Modigliani, 1963). The hypothesis is supported by a number of studies that find that saving falls and consumption increases when the share of elderly increases.[5]

The possibility of consuming earlier is thus an important determinant of household demand. It requires access to credit. Most households are faced with some degree of credit restrictions.[6] Limited access to credit can reduce consumption in two ways (Romer, 2011). First, consumption among households with income that is lower than permanent income can be reduced. Second, households may have to save a larger buffer that can be used in situations where income falls.

The interest rate is also a determinant of consumption according to standard theory (e.g. Fisher, 1930; Hall, 1978 and Modigliani and Brumberg, 1954). The literature is not, however, consistent with regard to the sign or the magnitude of the effect.[7] Changes in the interest rate influence consumption through an income effect, a substitution effect and a wealth effect.[8] The income effect depends on the size of household debt and interest-bearing assets. Norwegian households have on average more debt than interest-bearing assets. As a result, an interest rate cut will reduce an average household's interest expenses more than its interest income. The positive income effect normally results in an increase in current consumption.[9] A lower interest rate also reduces the return on accumulated savings, which in isolation makes current consumption cheaper compared with future consumption. The substitution effect produced by lower interest rates also pushes up consumption. In addition, an interest rate cut can have a positive wealth effect because future income is discounted at a lower interest rate. A lower

[4] Permanent income is the present value of households' lifetime resources, which include wealth, future income and public transfers, spread equally over a lifetime (years).
[5] See Attfield and Cannon (2003), Higgins (1998), Horioka (1997) and Masson et al. (1996).
[6] The analysis by Muellbauer et al. (2015) concludes that improved access to credit results in an increase in house prices, debt and consumption in Canada.
[7] Hall (1988) did not find a strong correlation between the interest rate and US household consumption (intertemporal substitution elasticity), while Gruber (2006), Mulligan (2002) and Weber (1970) found a positive correlation between the interest rate and consumption in the US. Erlandsen and Nymoen (2008) and Muellbauer et al. (2015) found a negative correlation between the interest rate and consumption in Norway and in Canada. Jansen (2012) confirmed the findings of Erlandsen and Nymoen (2008) for Norway when he estimated their model over other periods. Jansen (2012) also estimated intertemporal optimisation conditions, where consumption does not depend on current income (Euler equations). Jansen then found a positive correlation between the real interest rate and consumption in Norway. The correlation was, however, not significant at a 5 percent significance level.
[8] The model presented in Erlandsen and Nymoen (2008) divides the effect of an interest rate change into an income effect and a substitution effect. Disposable income captures the income effect of an interest rate change because it includes both interest income and interest expenses. The real interest rate captures the remaining effect of an interest rate change. Erlandsen and Nymoen (2008) find a significant, negative effect from the real interest rate (substitution effect) on Norwegian consumption.
[9] Liane (2013) shows, using a deterministic life-cycle model, that an interest rate cut only results in a moderate increase in household consumption in Norway because Norwegian households have on average relatively low net debt. Based on the assumption that Norwegian households have a higher propensity to allow consumption to vary over time (high substitution elasticity), an interest rate cut will lift consumption to a greater degree.

interest rate can also increase households' housing wealth.[10] If it is possible to raise more debt when housing wealth increases, as is the case in Norway[11], an increase in housing wealth can boost consumption (Muellbauer et al., 2015; Muellbauer and Williams, 2011 and Aron et al., 2012).[12]

The overall effect of an interest rate change will depend on whether the life-cycle and permanent income hypothesis holds true, i.e. the extent to which households prefer relatively stable consumption over a lifetime and the degree of access to credit. In a model that builds on the life-cycle and permanent income hypothesis, variations in current income have little impact on consumption. Gains from lower interest rates are largely saved for future consumption. Households that cannot consume earlier as a result of credit constraints may be willing to consume a larger share of the temporary increase in income resulting from an interest rate cut.

Precautionary saving increases when households become more uncertain about income developments (e.g. Ljungqvist and Sargent, 2004 and Romer, 2011). Alexopoulos and Cohen (2009) developed an index based on how often economic uncertainty was mentioned in the media and found a negative correlation between the index and consumption in the US. High household debt ratios can amplify precautionary saving and dampen consumption further. Bunn and Rostom (2015) show that UK households with high debt ratios reduced consumption more than other households during the financial crisis. Their analyses, which are based on microdata, indicate that a cut in consumption as a result of high debt ratios may have reduced aggregate consumption in the UK by up to 2 percent during the financial crisis. A number of other microdata-based studies find comparable results for other countries (Dynam, 2012 and Andersen et al., 2014).[13]

4. Literature and empirical evidence in Norway

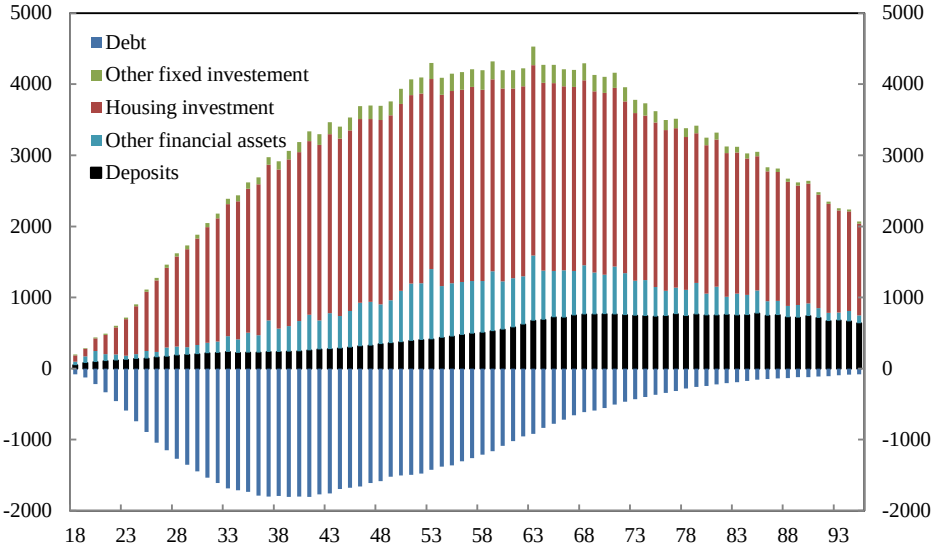
Up to the start of the 1980s, consumption developments in Norway were generally modelled based on the absolute income hypothesis, which asserts that households consume a fixed share of income at all times (Erlandsen and Nymoen, 2008).When Norwegian credit markets were liberalised at the beginning of the 1980s, consumption growth was to a greater degree decoupled from income growth, breaking the traditional relationship between consumption and income. Several Norwegian studies then expanded the consumption models to include household wealth measures (Brodin and Nymoen, 1992; Eitrheim at al., 2002 and Jansen, 2012)[14].[15]

More recent Norwegian studies are based to a greater extent on the assumption that households prefer relatively stable consumption over a lifetime. The life-cycle hypothesis is consistent with

[10] Jacobsen and Naug (2004) find that house prices in Norway increase rapidly and sharply after an interest rate cut. Housing wealth, which accounts for the largest share of household wealth in Norway, is particularly sensitive to changes in house prices.
[11] Banks in Norway offer interest-only loans secured on dwellings, often called home equity loans or lines of credit, whereby the borrower can borrow up to 70 percent of the value of the dwelling. Principal payments are required for loans exceeding 70 percent of the value of the dwelling.
[12] Increased housing wealth results in higher consumption in countries where it is possible to raise additional debt when housing wealth increases, i.e. Australia, the UK and the US (Muellbauer et al., 2015, Muellbauer and Williams, 2011 and Aron et al., 2012). In other countries where such loan products are not available, such as Italy, Japan, Canada, France and Germany, higher house prices and increased housing wealth can have a negative effect on consumption. Home owners cannot necessarily raise more debt when their housing wealth increases, while home buyers must use a larger portion of their permanent income to buy a home when house prices rise.
[13] Andersen et al. also shows that the consumption ratio among Danish households with the highest debt ratios was higher than for the average household in the period leading up to the financial crisis.
[14] Jansen (2012) showed that consumption equations that incorporate wealth effects explain consumption developments better than other equations. Jansen compared the explanatory power of two Euler equations with consumption equations that incorporate wealth effects in the period 2006-2008. In the first Euler equation, consumption is modelled as a random walk, i.e. consumption depends on consumption in the preceding quarter and an error term. In the other Euler equation, consumption depends on the real interest rate, consumption in the preceding quarter and an error term.
[15] Brodin and Nymoen (1992), Eitrheim et al. (2002) and Jansen (2012) found a cointegrating relationship between consumption, disposable income and wealth in their data series that comprised the 1980s.

Norwegian data. Erlandsen and Nymoen (2008) found that changes in the age composition of the population explained some of the change in Norwegian consumption. [16] In Norway, younger households have substantial debt and little financial wealth, while middle-aged households have more financial wealth in the form of bank deposits, equities and other securities (Chart 5). Elderly households have substantial bank deposits and little debt.

Chart 5 Wealth and debt by age of main income earner. 18 – 95 years. Assessed values. Average. In thousands of NOK. 2014



Source: Statistics Norway

It is more demanding to assess whether the permanent income hypothesis is consistent with Norwegian data because permanent income is not directly measurable. Several indicators can, however, capture swings in that variable. Chart 5 shows that housing accounts for the bulk of household wealth in Norway, particularly among younger households. The assets of these households are thus particularly sensitive to changes in house prices and a share of their wealth will be wiped out in the event of a fall in house prices.[17] In addition, both equity prices and oil prices can contain information about household wealth and future income.

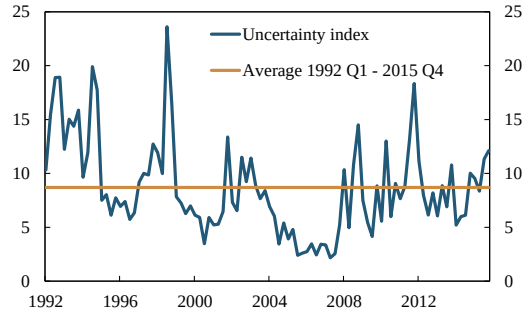
More recent studies have expanded the consumption function to include more variables, among other things based on the theory of precautionary saving. Gudmundsson and Natvik (2012) used the same method as Alexopoulos and Cohen (2009) and estimated an uncertainty index for Norway.[18] They found a negative correlation between the uncertainty index and Norwegian consumption in the period 1985-2011.[19] The index explains a greater share of developments in Norwegian consumption than two other uncertainty measures that are based on Norwegian[20] and US equity prices[21]. Blomhoff Holm (2015) developed a simple heterogeneous agent model[22] to analyse the increase in the Norwegian saving ratio after the financial crisis. The model showed that a little more than two percentage points of the increase in the saving ratio can be explained by an increase in income uncertainty and a more skewed distribution of

[16] Erlandsen (2003) finds that persons in the age group 50-66 have the lowest propensity among adults to consume. According to the model-based findings of Erlandsen and Nymoen (2008), consumption falls by 0.31 percent if the share of middle-aged increases by 1 percentage point.
[17] Sommervoll (2007) did not, however, find any correlation between increased housing wealth and debt-financed consumption in Norway in the period 1993-2000.
[18] The uncertainty index is constructed by counting the number of Norwegian news articles that contain the key words "economy" and "uncertainty" in the same article. To correct for an increase in the number of journals during the period, the index is trend-adjusted.
[19] The analysis shows that increased uncertainty has a significant negative effect on consumption for up to two years.
[20] Implied volatility in call options on Oslo Børs (OBX).
[21] Implied volatility measured by the Chicago Board of Options VXO Index.
[22] The model builds on a version of Hugget (1993) with continuous time and incomplete markets. The model is calibrated so that the distribution of income and wealth is consistent with the tax return data for Norwegian households before the financial crisis.

income and wealth. Fagereng et al. (2016) use microdata to study Norwegian households' saving behaviour in response to staff cuts at their workplace. The results indicate that the households concerned increase their financial saving considerably before they become unemployed or their job is eliminated.[23]

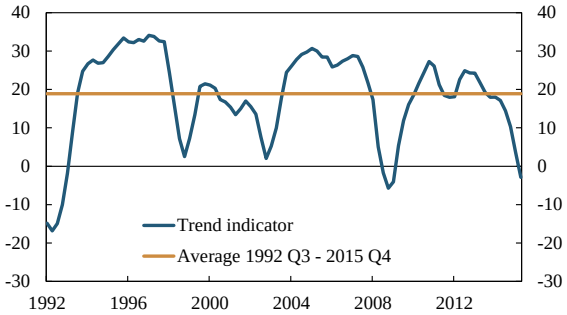
The index estimated by Gudmundsson and Natvik (2012) is now at a higher level than the average back to 1992 (Chart 6). At the same time, consumer confidence is at historically low levels (Chart 7). This may indicate that uncertainty is now dampening consumption.

Chart 6. Uncertainty index. Frequency of the words "economy" and "uncertainty" in same news item in the Norwegian press. 1992 Q1 – 2015 Q4



Sources: Norges Bank and Retriever

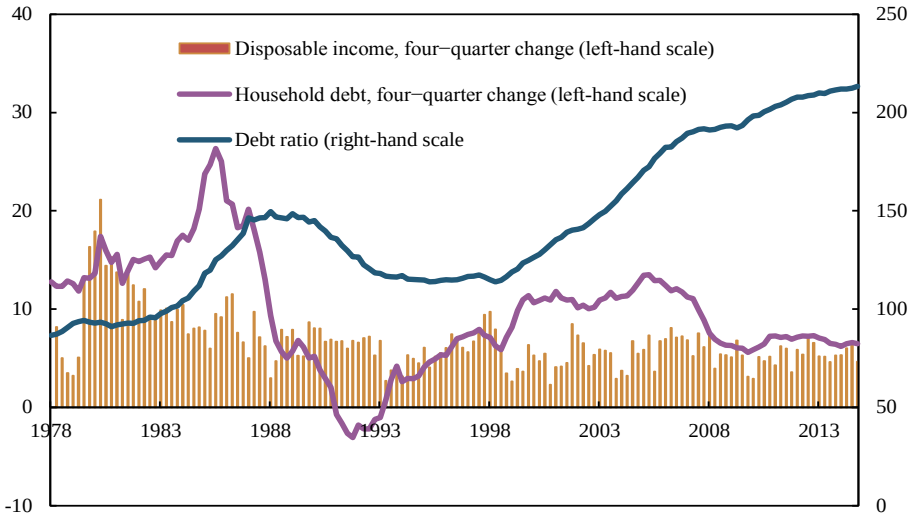
Chart 7. TNS Gallup's trend indicator for households. Composite index. Seasonally adjusted net figures. 1992 Q3 – 2015 Q4



Source: TNS Gallup

High household debt ratios can also lead to precautionary saving and lower consumption (Bunn and Rostom, 2015; Dynam, 2012 and Andersen et al., 2014). Fagereng and Halvorsen (2016) show that consumption growth for highly indebted Norwegian households has been lower than for other households. Debt ratios for Norwegian households are now historically high after a substantially faster rise in debt than in disposable income since the end of the 1990s (Chart 8). This may have contributed to pushing up precautionary saving in Norway, particularly if households with high debt ratios regard periods of low interest rates as a temporary phenomenon. In that case, the temporary growth in disposable income will have a relatively small impact on household demand (Liane, 2013).

Chart 8. Household debt ratio.[1)] Percent. 1978 Q4 – 2015 Q3



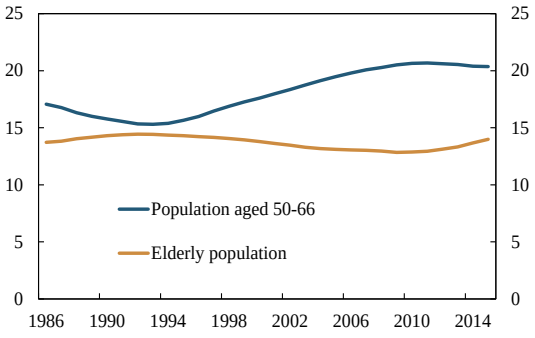
1) Loan debt as a percentage of disposable income adjusted for estimated reinvested dividend income for 2003 – 2005 and redemption/reduction of equity capital for 2006 Q1 – 2012 Q3.
Sources: Statistics Norway and Norges Bank

[23] According to the findings of Fagereng et al. (2016), households on average use the private financial buffer to cover 25 percent of the income shortfall that occurs in the event of unemployment.

5. Other driving forces behind Norwegian consumption

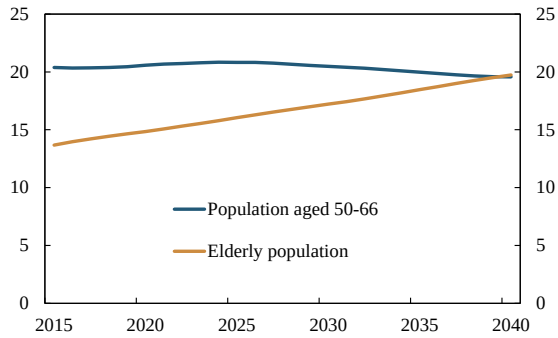
Consumption has likely been influenced by a number of structural changes that are not captured by the traditional theoretical models. **Demographic changes** may have changed the equilibrium level for the consumption ratio over the past decades. Since the beginning of the 1990s, the share of persons aged 50-66 (middle-aged) has risen (Chart 9). Erlandsen and Nymoen (2008) estimated how a change in the age composition of the population affects private consumption. They concluded that the increase in the share of the middle-aged in the period 2000-2008 may in isolation have contributed to pushing up the saving ratio by up to 2 percentage points. In the period 2011-2015, the share of middle-aged may have edged down. The estimated relationship presented by Erlandsen and Nymoen (2008) indicates that it may have lifted the consumption ratio by up to 0.3 percentage point. Population projections indicate that the share of middle-aged will remain broadly unchanged in the coming years (Chart 10)

Chart 9. Share of middle-aged (persons aged 50-66) and elderly (persons aged over 66) in Norway. Percent. 1986 – 2015



Source: Statistics Norway

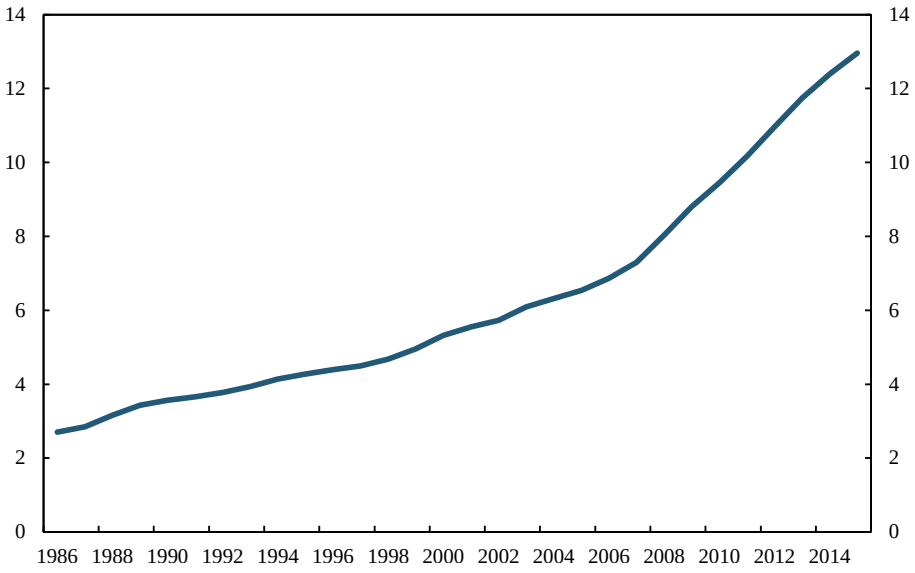
Chart 10. Projections of share of middle-aged (50-66) and elderly (over 66). Percent. 2015 – 2040



Source: Statistics Norway

A larger share of immigrants in Norway has likely reduced the equilibrium level for the consumption ratio in recent years. The share of immigrants in Norway has increased after the accession of 10 additional countries to the EU in 2004 and two more in 2007 (Chart 11), primarily owing to labour immigration from EU member countries in Central and Eastern Europe.

Chart 11. Number of immigrants in Norway as a share of the population. Percent. Annual figures. 1986 – 2015



Source: Statistics Norway

The saving ratio for immigrants as a whole is probably higher than the average for Norway. Data do not exist for the share of income saved by labour immigrants from Central and Eastern Europe. According to a survey of Poles in Oslo in 2006 (Friberg and Tyldum, 2007), many transferred money to their home country or returned with savings after expiry of their work contract. In spite of relatively low income levels, 80 percent responded that they had saved money while in Norway. About half responded in a comparable survey from 2010 (Friberg and Eldring, 2011) that they transferred money to their home country. Saving among labour immigrants may, however, decline as they settle with their families in Norway.[24] Simple estimations indicate that labour immigrants from Eastern and Central Europe save about 40 percent of their income.[25] This can explain up to 1 percentage point of the increase in the saving ratio in 2014 and a comparable fall in the consumption ratio.

Income developments for different age groups may also influence the consumption ratio because the propensity to consume income increases among middle-aged households (50-66) is lower than for younger (20-49) and elderly (over 66) households (Erlandsen, 2003). In the period 2010-2013, income growth for the elderly was 20 percent. In the same period, overall income growth for the middle-aged was 15.7 percent, while the figure for younger households was 11.6 percent. Income developments resulted in a fall in the income share for younger households, while the income share for middle-aged and elderly households increased (Chart 12). The increase in the income share for middle-aged households with a low propensity to consume may have contributed to keeping down the consumption ratio in recent years. The increase in the income share for elderly households has probably pulled in the opposite direction. Estimated income elasticities[26] for aggregate consumption in Norway vary between 0.56 (Brodin and Nymoen, 1992) and 0.66 (Erlandsen and Nymoen, 2008). Estimations that assume that income elasticity is lower for middle-aged households (0.55) than for younger (0.65) and elderly (0.65) households show that the consumption ratio might have been 0.9-1.7 percentage points higher if income growth had been the same for all age groups in the period 1994-2013.[27] The calculations also show that the consumption ratio has not been affected to an appreciable extent by income developments for the different age groups since the financial crisis.

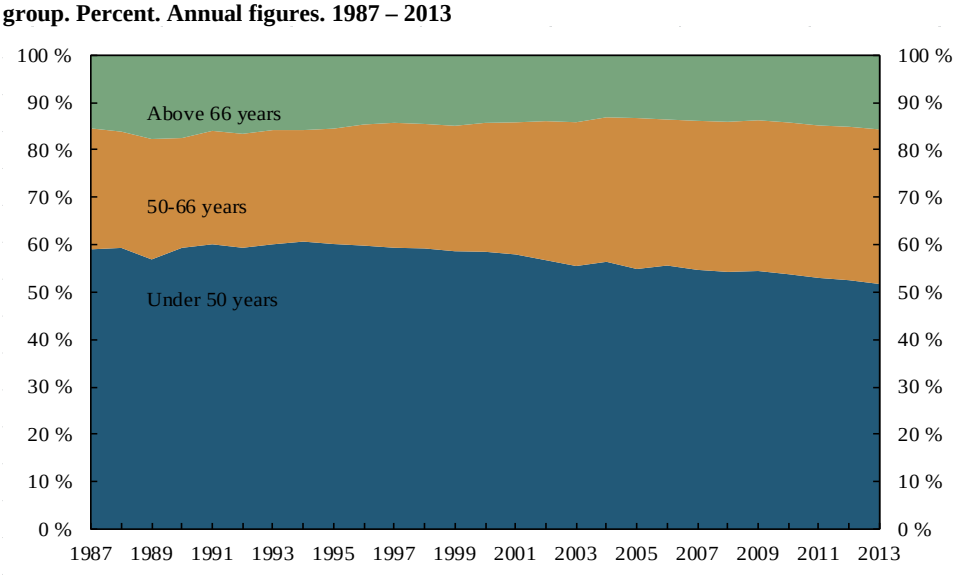
[24] According to Friberg and Eldring (2011), it is primarily Polish labour immigrants with a partner residing in Poland who transfer money to their home country. In the period between the two surveys, the Polish population became more settled in Norway. While the majority had a partner residing in Poland in 2006, the majority had a partner residing in Norway in 2010.

[25] We estimate consumption for Eastern European labour immigrants based on the reference budget of the National Institute for Consumer Research, a reasonable assumption concerning housing expenses and an assumed averge income after taxes of NOK 250 000. Most labour immigrants who have come to Norway over the past 10 years are Polish. In 2014, median household equivalent income after tax for Polish households was estimated at NOK 268 000. By comparison, the same income measure for Norway's total population was NOK 348 000. Labour immigrants from other countries, e.g. Lithuania, have a lower level of median income than those from Poland. In order to compare income for households of different size and composition, household income is normally adjusted by means of an equivalence scale or consumption weights. According to the EU scale, the first adult household member should be given a weight of 1.0 and the next adult 0.5, while children are given a weight of 0.3. The average size of Polish households in Norway was 1.3 persons. Assuming that they are adults only, that the households have two incomes and the remainder has one income, the result is a median income after taxes per Pole in Norway of NOK 270 000.

[26] Percentage change in consumption when income increases by one percentage point.

[27] We assume constant total income growth.

Chart 12. Disposable income as a percentage of total disposable income for Norwegian households by age group. Percent. Annual figures. 1987 – 2013



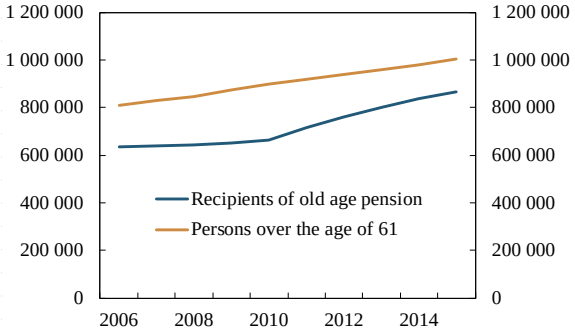
Source: Statistics Norway

The pension reform that entered into force on 1 January 2011 may in isolation have reduced the equilibrium level for the consumption ratio. The reform made expected pension payments neutral, which in practice means that the longer the beneficiary waits to receive pension payments, the bigger the payments will be. The reform also introduced a life expectancy adjustment mechanism that reduces annual pension payments when the estimated average life expectancy of the population rises. As life expectancy is expected to rise ahead, the life adjustment mechanism will result in lower annual pension payments for current and future employees.[28] There is evidence to suggest that households have adapted to the pension reform by working longer and saving more. Figures from the Finansbarometer survey[29] indicate that more people want to work longer after the pension reform was introduced. According to the survey, the share of workers that want to retire before 67 has declined from 57 percent in 2010 to 42 percent in 2015. The same survey also shows that the share of Norwegian households that save owing to the pension reform has increased from 20 percent in 2010 to 27 percent in 2015. Our calculations indicate that the life expectancy adjustment, combined with increased awareness concerning the need for personal saving, may in isolation have reduced the consumption ratio by 0.8-1.6 percentage points in the period 2011-2015.[30]

The pension reform also provides persons in the age group 62-67 with the opportunity to remain occupationally active even when withdrawing a full pension. For this group, pension payments come in addition to wage income, which provide a temporary high level of income until actual working life ends. There is evidence to suggest that many have used this opportunity to withdraw pension benefits while continuing to work. Despite an increase in the number of old-age pension beneficiaries of 205 000 persons between 2010 and 2015 (Chart 13), the labour supply for the relevant age groups has not fallen (Chart 14). In the same period, the number of persons over 61 increased by 105 000. If, for example, 100 000 persons work in addition to withdrawing old-age pension benefits and the average pension income after taxes is NOK 200 000, the total additional income comes to NOK 20 billion. Assuming that only a fifth of this additional income is spent on consumption, it reduces in isolation the consumption ratio by 0.6-1.3 percentage points.

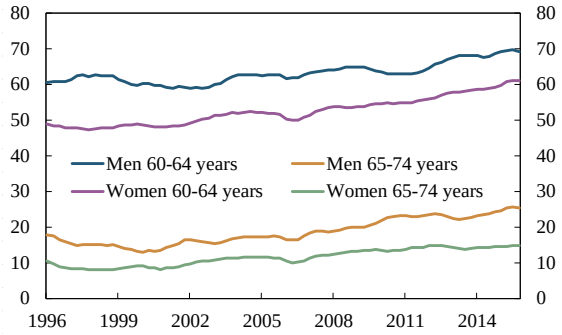
[28] A transtional arrangement provides that the reform does not apply to persons born before 1954.
[29] The Finansbarometer 2015 (2010) comprises 3166 (1238) interviews of persons over 18.
[30] The calculations are based on data from the Norwegian Labour and Welfare Administration (NAV) on necessary withdrawal age to compensate for the life expectancy adjustment. We assume unchanged saving behaviour owing to the life expectancy adjustment for persons under 40 and over 61 (due to the transitional rule). We assume a linear increase in the share of persons who change their saving behaviour from 4 percent for those aged 40 to 70 percent for the age group 55-61. We assume that those who change their saving behaviour save on average an amount corresponding to half the effect of the life expectancy adjustment.

Chart 13. Old-age pension beneficiaries and persons aged over 61. Number. 2006 – 2015



Sources: NAV and Statistics Norway

Chart 14. Employment rate. 1996 Q1 –2015 Q4



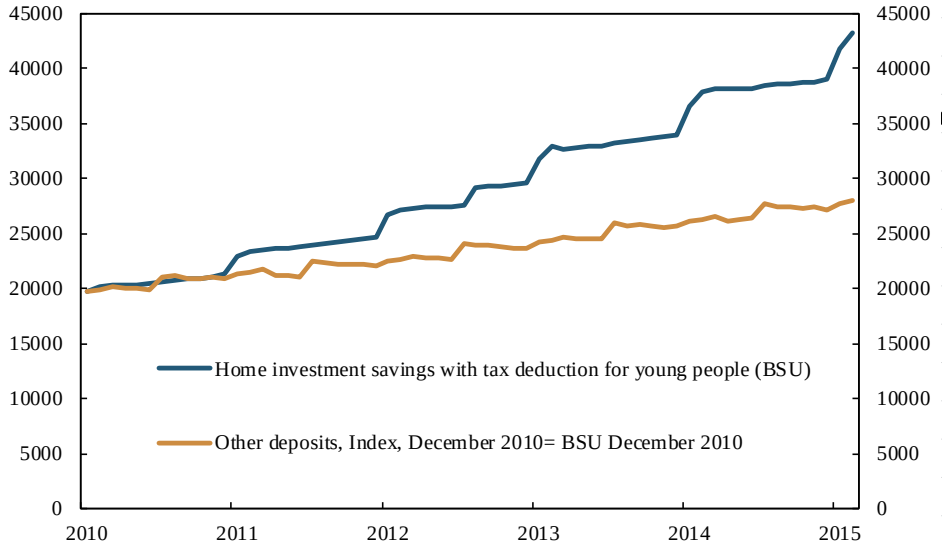
Source: Statistics Norway

Stricter borrowing requirements for Norwegian households may have increased saving and curbed consumption after the financial crisis, particularly among younger households that are saving to make their first home purchase. In order to limit the volume of loans in relation to income and the value of the dwelling, Finanstilsynet (Financial Supervisory Authority of Norway) introduced guidelines for prudent residential mortgage lending in March 2010.[31] The guidelines were tightened further in December 2011.[32] In June 2015, the Ministry of Finance issued a regulation setting out requirements for new residential mortgages. The regulation is based on the Finanstilsynet's guidelines, but a principal payment requirement was introduced at the same time.[33] Simple calculations show that stricter bank lending practices in Norway may have lifted the saving ratio by up to 0.2 percentage point in recent years and reduced the consumption ratio by a comparable margin.[34] The effect is smaller than that found by Carroll et al. (2012) for the US.[35]

Increase in the savings amount allowed under the youth home equity savings plan (BSU) may have curbed household consumption in Norway in recent years. Compared with other deposit forms, the BSU savings plan is clearly advantageous[36], and in recent years the plan has been expanded.[37] Total holdings of BSU deposits have almost doubled from about NOK 20 billion at the beginning of 2011 to NOK 42 billion at end-2015 (Chart 15). In the same period, other deposits increased by 40 percent overall. At that growth rate, BSU holdings would have been NOK 14 billion lower. Assuming that the distinctly high growth of NOK 14 billion is due to the expansion of the savings plan, calculations show that the expanded savings plan may have increased the saving ratio by up to 0.1 percentage point in recent years.

[31] According to the guidelines, the loan should not normally exceed 90 percent of the dwelling's market value.
[32] The loan-to-value ratio requirment was tightened to 85 percent. At the same time, the updated guidelines stipulated that the assessment of households' debt-servicing capacity should allow for an interest rate increase of 5 percentage points.
[33] Annual principal payments of at least 2.5 percent should be made for approved loans with a loan-to-value ratio of over 70 percent.
[34] The purchase amount is set equal to the average purchase amount for a Norwegian dwelling. The loan is assumed to be 85 percent of the home purchase amount. We assume that borrowers who are limited by the home equity capital requirement must increase savings by an amount equivalent to 5 percent of the home purchase amount. We assume that borrowers who are limited by the principal payment requirement must repay the loan over 25 years. We assume that the share of home purchase transactions that are limited by the home equity capital requirement and the principal payment requirement has increased by 6 and 13 percentage points, respectively, between 2011 and 2015. The assumption is based on Finanstilsynet's residential mortgage surveys, which show that the share of loans with a loan-to-value ratio in excess of the limit in the guidelines (90 percent up to 2012 and 85 percent thereafter) fell from 22 percent in 2011 to 16 percent in 2015. In the same period, the share of interest-only residential mortgages fell from almost 25 percent to 11 percent.
[35] Carroll et al. (2012) find that 0.6 percentage point of the increase in the saving ratio in the US between 2007 and 2010 is ascribable to tighter lending practices.
[36] BSU savings normally provide more favourable interest terms than ordinary deposits. In addition, the scheme allows an income tax deduction of 20 percent of the annual savings amount.
[37] In 2009, the maximum annual BSU savings amount was increased from NOK 15 000 to NOK 20 000. In 2014, the maximum annual savings amount was increased further to NOK 25 000 and the total savings amount was increased from NOK 150 000 to NOK 200 000. Effective from 2016, the Government has proposed to increase the upper limit to a total of NOK 300 000. The maximum annual savings amount will remain at NOK 25 000.

Chart 15. Youth home equity savings (BSU) for Norwegian households. Bank deposits. In millions of NOK. December 2009 – January 2016



Source: Statistics Norway

6. Estimation of consumption equations

We estimate a model combining insight from traditional consumption equations with more recent theories. A theoretical consumption equation is given by:

$$(1)\quad C_t = Y_t^{\beta_Y} F_t^{\beta_F} B_t^{\beta_B} G_t^{\beta_G} i_t^{\beta_i}$$

, where C_t is household consumption in the period t, Y_t is household disposable income adjusted for share dividends, F_t is household financial wealth, B_t is household housing wealth, G_t is household debt and i_t is nominal lending rates to households[38]. The parameters β_Y, β_F, β_B and β_G show the percentage change in consumption in the event of a one percent change in income, financial wealth, housing wealth and debt, respectively (consumption elasticity). The parameter β_i shows the percentage change in consumption in the event of a one percentage point change in lending rates (semi-elasticity). Our theoretical consumption equation differs from previous consumption equations for the Norwegian economy in that we have split household wealth into two parts instead of total net wealth at constant prices.

According to the theory presented in Section 3, increased income and gross wealth should in the long run lead to higher consumption, while increased gross debt and higher interest rate levels should curb growth in consumption. We therefore expect the estimated income and wealth elasticities to be positive (β_Y, β_F, $\beta_B > 0$) and the debt and interest rate elasticities to be negative (β_G, $\beta_i < 0$).

Equation (1) is estimated as an error correction model, where the general model is given by:

$$(2)\quad \Delta log(C_t) = \alpha(log(C_{t-1}) - \beta_Y log(Y_{t-1}) - \beta_F log(F_{t-1}) - \beta_B log(B_{t-1}) - \beta_G log(G_{t-1}) - \beta_i i_{t-1}) + shortrun\ dynamics + constant + \varepsilon_t$$

, where ε_t is the error term, assumed to be normally distributed with constant variance.

[38] We use nominal interest rates in the model calculation as nominal interest rates capture short-run cash-flow effects as a result of interest rates changes to a greater extent than real interest rates. In addition, real interest rates are calculated as nominal interest rates less inflation expectations or the inflation target. As inflation expectations (and the inflation target since 2001) have been relatively stable over the estimation period, real interest rates will largely vary in pace with nominal interest rates.

The short-run dynamics include consumption in preceding periods and income, financial wealth, housing wealth, debt and nominal interest rates as difference terms. Based on the review of theory, literature and driving forces in Sections 3-5, we have also tested a number of other variables (Appendix Table A1), including how income uncertainty, house prices and access to credit affect consumption. We have attempted to capture uncertainty with regard to future income using changes in consumer confidence and the level of newspaper-based uncertainty[39]. We expect the estimated consumer confidence coefficient to be positive and the newspaper-based uncertainty coefficient to be negative. We have attempted to capture banks' credit standards using the spread between lending rates to households and money market rates. We expect the estimated lending margin coefficient to be negative, i.e. a wider spread lowers consumption.

The short-run dynamics are thus given by:

(3) $$shortrun\ dynamics = \sum_{j=1}^{3} \delta_{C,j} \Delta\, log(C_{t-j}) + \sum_{j=0}^{3} \left(\delta_{Y,j} \Delta log(Y_{t-j}) + \delta_{F,j} \Delta log(F_{t-j}) + \delta_{B,j} \Delta log(B_{t-j}) + \delta_{G,j} \Delta log(G_{t-j}) + \delta_{i,j} \Delta i_{t-j} + \delta_{H,j} \Delta log(H_{t-j}) + \delta_{PBU,j} PBU_{t-j} + \delta_{M,j} M_{t-j} + \delta_{T,j} \Delta T_{t-j} \right)$$

where Δ is a differential operator, PBU_t is a newspaper-based uncertainty index, M_t is banks' margin on loans to households, H_t is nominal house prices and T_t is consumer confidence.

The consumption equation is estimated on seasonally adjusted data from 1994 Q1 to 2015 Q3. As the period before 1993 was characterised by major structural changes, pre-1993 data are not used.[40] We do not reserve some of the data sample for forecast testing as we are interested in modelling the driving forces behind consumption since the financial crisis using as many observations from this period as possible. We start by estimating the general model (2) and simplify both the short-run and the long-run solution using the automatic model selection algorithm Autometrics (Doornik, 2009).

The estimation results are summarised in Table 1. Tests show that the model is well-specified, and the model is stable when estimated recursively (Tables A2 and A3). The error term is stationary[41] and does not contain autocorrelation[42] or heteroskedasticity[43]. The estimated coefficient of the error term is significantly different from zero, which is strong evidence of cointegration.[44]

Table 1: Estimated consumption equation[1)]

	Coefficient	t-value
Financial wealth, $\Delta log(F_t)$	0.21***	3.8
Income, $\Delta log(Y_t)$	0.15***	2.8
Newspaper-based uncertainty, PBU_t[2)]	-0.05**	2.2
Lending margin, M_{t-3}[2)]	-0.83***	4.5
Consumer confidence, ΔT_{t-2}[2)]	0.07***	3.5
House prices, $\Delta log(H_{t-1})$	-0.13**	2.5

[39] We use the same method as Alexopoulos and Cohen (2009).
[40] Credit markets were deregulated in the 1980s and a tax reform was implemented in 1992. See Section 8 for a more detailed description of these structural changes.
[41] If the error term is not stationary, its value will rise or fall over time.
[42] If the error term contains autocorrelation, the value of the error term in period t will affect the value of the error term in period t+1.
[43] If the error term contains heteroskedasticity, the error term does not have a constant variance over time.
[44] Cointegration can be measured by testing the significance of the error correction term in line with the Engle-Granger representation theorem. According to this theorem, error correction implies cointegration and vice versa (Engle and Granger, 1987). We have tested the significance of the error correction term based on the Ericsson and MacKinnon (2002) critical values as the coefficient does not follow a normal t-distribution under the null hypothesis of non-cointegration.

Constant	1.69***	4.8
Adjustment velocity	-0.57***	7.1
Income elasticity, $log(Y_{t-1})$	0.51***	6.4
Financial wealth elasticity, $log(F_{t-1})$	0.16***	3.1
House price elasticity, $log(B_{t-1})$	0.07***	2.8
Interest rate semi-elasticity, i_{t-1}	-0.69***	4.4
Tests[3)]		
AR 1-5	F(5.70)	0.82 (0.54)
ARCH (4)	F(4.79)	0.50 (0.74)
Normality	$\chi^2(2)$	3.74 (0.15)
Heteroskedasticity	F(22.64)	1.38 (0.16)
Durbin-Watson		2.23
Residual standard deviation (percent)		0.67%
Adjusted R^2		0.53

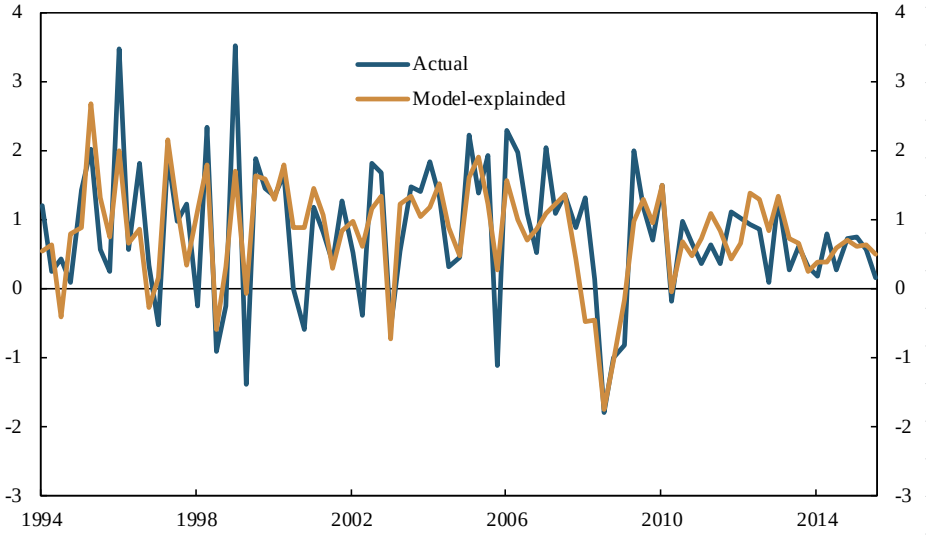
1) *** and ** show that the variable is significant at the 1 and 5 percent level of significance respectively.
2) Explanatory variables divided by 100.
3) See Doornik and Hendry (2006).

The error correction term includes income, financial wealth, housing wealth and nominal interest rates. The estimated long-run solution is in line with previous results. A permanent one percentage point increase in income increases consumption by 0.51 percent. By comparison, previous studies find income elasticities of between 0.56 and 0.66 percent (Jansen, 2012). We also find that a one percentage point increase in financial wealth and housing wealth increases consumption by 0.16 and 0.07 percent respectively. This is in line with the results of Muellbauer et al. (2015), who find higher elasticities for Canadian households' liquid assets than for their housing wealth. Other studies find elasticities between 0.13 and 0.27 for households' total wealth. For interest rates, we find that a 1 percentage point increase pulls down consumption by 0.69 percent, compared with estimates of between 0.42 and 1.95 percent in other studies. The adjustment velocity is estimated at 0.57 percent, compared with between 0.34 and 0.96 percent in earlier studies. The adjustment velocity is the rate at which the deviation between actual and equilibrium consumption levels in the model is corrected per period.

Of the potential explanatory variables in the short-run dynamics, changes in financial wealth, income, consumer confidence and housing wealth, as well as the level of newspaper-based uncertainty and lending margins have significant explanatory power. The coefficients have the expected signs. Consumption is affected positively by financial wealth and income and negatively by lending margins. In line with the results in Gudmundsson and Natvik (2012), Blomhoff Holm (2015) and Fagereng et al. (2016), consumption growth is reduced by lower consumer confidence and increased uncertainty.

An increase in house prices has a dampening effect on consumption growth in the short run. The explanation may be that higher house prices in the short run result in increased household borrowing and higher household savings in order to service debt, in accordance with the findings of Muellbauer et al. (2015) in Canadian data. It is also in line with the results of Fagereng and Halvorsen (2016), who find that growth in consumption for Norwegian households with high debt is weaker than for other Norwegian households. In the longer run, consumption rises with house prices in the model because higher house prices increase housing wealth in the long-run solution. An explanation for this may be that rising housing wealth allows home-owners to debt-finance spending to a greater extent.

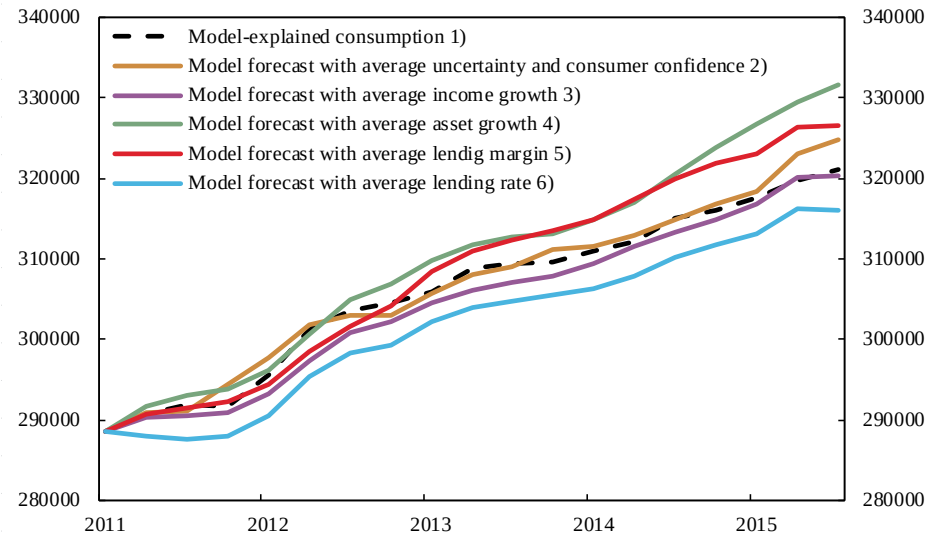
Chart 16. Actual and model-explained developments in consumption. Quarterly change. Percent. 1994 Q1 – 2015 Q3



Sources: Norges Bank and Statistics Norway

The model explains the variations in consumption growth to a substantial extent (Chart 16). According to the model, consumption following the financial crisis was constrained by more limited access to credit, lower wealth growth, lower consumer confidence and greater uncertainty about economic developments, while being supported by low interest rates. Chart 17 shows model-explained consumption. In addition, the chart shows various model forecasts, calculated using average values for one explanatory variable and actual values for the other explanatory variables. The model forecasts approximately the same consumption when actual income growth is used instead of average income growth, i.e. income growth has had a relatively neutral effect on consumption since the financial crisis. The model forecasts are higher than model-explained consumption when we use average values for access to credit, wealth growth, consumer confidence and uncertainty about economic developments, while the forecasts are lower when we use average values for interest rates.

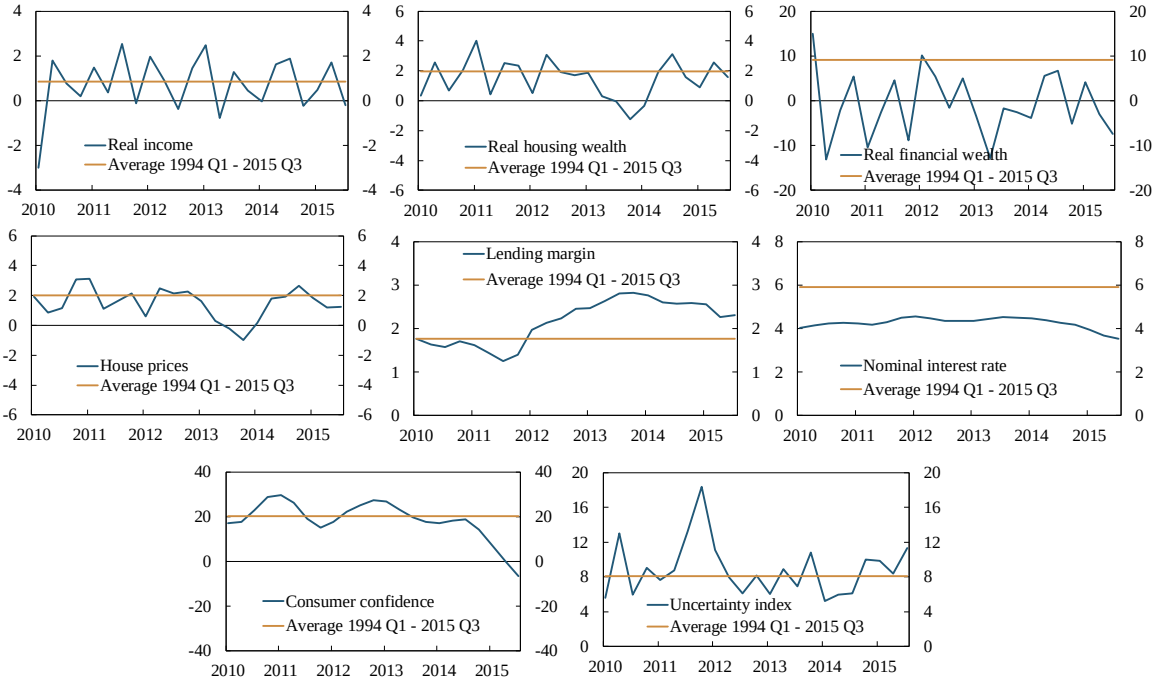
Chart 17. Model forecasts for consumption. Seasonally adjusted. Constant prices. In millions of NOK. 2011 Q1 – 2015 Q3.



1) Estimated based on actual values for all explanatory variables
2) As 1), but estimated with average uncertainty and consumer confidence for the period 1994Q1 - 2015Q3
3) As 1), but estimated with average income growth for the period 1994Q1 - 2015Q3
4) As 1), but estimated with average growth in total assets for the period 1994Q1 - 2015Q3
5) As 1), but estimated with average lending margin for the period 1994Q1 - 2015Q3
6) As 1), but estimated with average lending rate for the period 1994Q1 - 2015Q3
Source: Norges Bank

Chart 18 shows changes in the model's explanatory variables since the financial crisis. Since the financial crisis, the nominal interest rate has been considerably lower than its average for the period back to 1994. This has supported consumption. The lending margin and uncertainty index have at the same time been higher than the average for the model's estimation period, while consumer confidence has been lower than its historical average. More limited access to credit and greater income uncertainty have thus curbed consumption. In addition, growth in real housing wealth and real financial wealth since the crisis has been lower than the average for the model's estimation period. This has had a dampening effect on consumption growth. Real income growth has been close to its historical average.

Chart 18. Explanatory variables in the model. Quarterly growth in real income, real housing wealth, real financial wealth and house prices. Lending margin, nominal interest rate, consumer confidence and uncertainty. Level. 2010 Q1 – 2015 Q3.



Sources: Statistics Norway, Norges Bank and Retriever

7. Predictive properties

Norges Bank draws up forecasts of consumption four times a year as part of its work to prepare the *Monetary Policy Report*. Models with good predictive properties are useful in this work. We therefore assess the predictive properties of the model estimated in Section 6 from 2010 Q1 onwards. The model is estimated recursively and provides forecasts eight quarters ahead. In the first stage, the model is estimated on data for the period 1994 Q1 – 2009 Q4, and the model provides forecasts from 2010 Q1 onwards. In the second stage, the model is estimated on data for the period 1994 Q1 – 2010 Q1, and the model provides forecasts from 2010 Q2 onwards, and so on. This provides us with 16 rounds of model forecasts of eight quarters each.

We compare these with forecasts from a simple AR(1) model and from a VAR model. The AR(1) model explains consumption by

$$(4)\quad \Delta log(C_t) = constant + \Delta log(C_{t-1}) + \varepsilon_t$$

The VAR model is an expansion of the AR(1) model, including a larger number of explanatory variables and where the explanatory variables are lagged. The explanatory variables in the VAR model are given by a vector x_t

$$(5)\quad x_t = \left(\Delta log(C_t), \Delta log(Y_t), \Delta log(F_t), \Delta(i_t)\right)'$$

where the variables are defined as above. We limit our VAR model to the fundamental explanatory factors because the estimation period is relatively short. We estimate a third-order VAR given by

$$(6)\quad x_t = \mu + A_1 x_{t-1} + A_2 x_{t-2} + A_3 x_{t-3} + e_t$$

, where A is a (4×4) coefficient matrix, μ is a (4×1) vector of the constant term, and e_t is a (4×1) vector of the error term, which we assume is white noise with appropriate properties[45].

The AR(1) model and the VAR model are estimated recursively and provide forecasts in the same way as the consumption equation.

Our model exhibits better predictive properties than both the AR and VAR model for all horizons (Table 2). The consumption equation has, however, an advantage as the forecasts are conditional on actual developments in the explanatory variables. In column 3, we have reported predictive properties for our model when the forecasts are conditional on AR(1) forecasts of the explanatory variables, i.e. developments in all explanatory variables are forecasted recursively using models equal to the one in equation (4). The consumption equation then shows better predictive properties than the AR (1) model for horizons beyond three quarters, but poorer predictive properties on the whole than the VAR model. This does not necessarily imply that the consumption equation provides poorer real time forecasts than the autoregressive models because the real time forecasts from the consumption equation will normally be conditional on robust forecasts of the explanatory variables.

Table 2. RMFSE (mean forecasting error)[46] of the consumption equation and VAR model. 2010 Q1 – 2015 Q3. RMFSE is normalised by dividing by RMFSE for the AR(1) model. Values above 1 indicate a smaller forecasting error than for the AR(1) model.

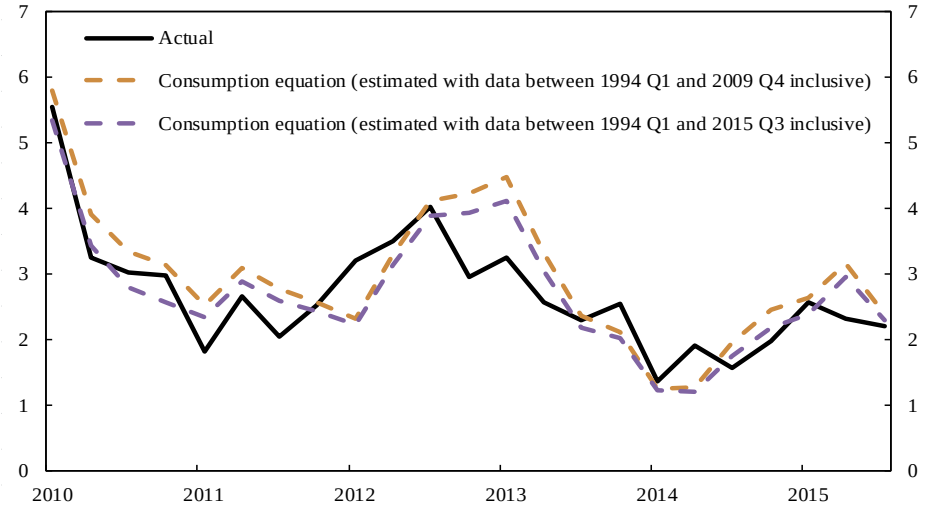
Number of quarters ahead	Consumption equation conditional on actual developments in explanatory variables	Consumption equation conditional on AR(1) model forecasts of explanatory variables	VAR model
1	0.9	1.3	0.9
2	0.8	1.4	1.1
3	0.6	1.1	1.0
4	0.5	1.0	0.9
5	0.5	1.0	0.9
6	0.4	0.9	0.9
7	0.4	0.9	1.0
8	0.4	0.9	0.9

Chart 19 shows a comparison of the forecasts provided by our model from 2010 Q1 with actual developments in consumption in the period 2010 – 2015. The estimates are based on data to the end of 2009 Q4. The model explains most of the variations in consumption since 1994. We have also included model forecasts estimated on data to the end of 2015 Q3. As expected, the model fits actual developments somewhat better with a longer estimation period, although the difference from the model with a shorter estimation period is not substantial. This indicates that the estimated relationships in the model have remained relatively stable over the past five years.

[45] $E[e_t] = 0, E[e_t, e_s'] = \begin{cases} \omega & for\ t=s \\ 0 & ellers \end{cases}$

[46] $RMFSE = \sqrt{\sum_{t=i}^{n}(\hat{c}_i - c)^2/n}$, where $\hat{c}_i$ is forecast *i* for a given horizon and *n* is the number of model forecast rounds.

Chart 19. Four-quarter growth in private consumption. Constant prices. Model forecasts[1)] compared with actual developments. 2010 Q1 – 2015 Q3

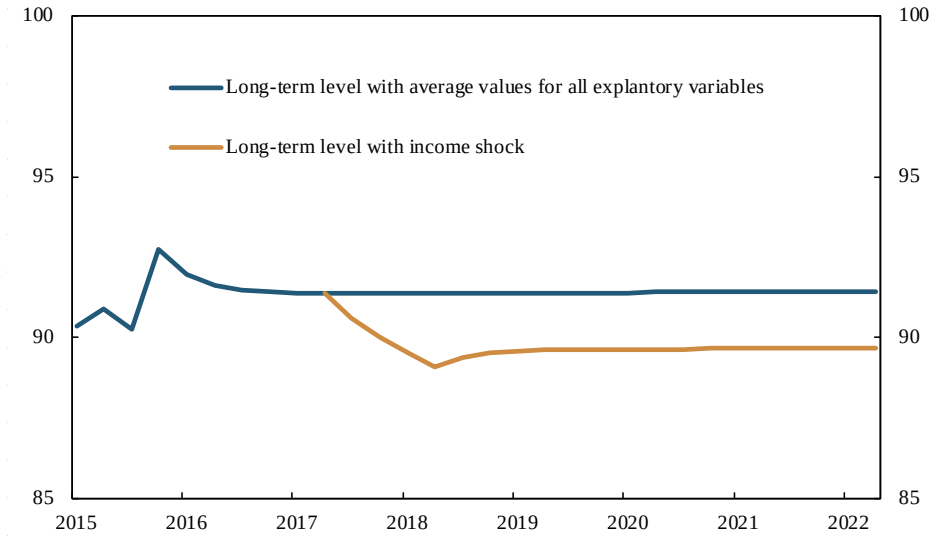


1) Projections based on actual developments in the explanatory variables
Sources: Norges Bank and Statistics Norway

8. Long-run equilibrium level

We also assess the model's forecasting properties in the long run by projecting the ratio of consumption to disposable income up to 2022. The first projection sets future values of the explanatory variables equal to their average values for the estimation period 1994-2015. The consumption ratio then moves from today's level of around 90 percent to a long-run level of around 91.5 percent (Chart 20). This implies that the consumption ratio will increase by 1-2 percentage points from today's level as the fundamental explanatory factors normalise. In the simulation, growth in disposable income (denominator) is at the same level as actual growth in recent years, but the normalisation of the other explanatory variables contributes to temporarily stronger growth in consumption (numerator). The consumption ratio thus increases temporarily to above the long-run equilibrium level before being gradually reduced to the equilibrium level by the equilibrium adjustment term.

Chart 20. Ratio of consumption to disposable income. Projected ratio with and without income shock in 2018. Percent. 2015 – 2022



Sources: Norges Bank and Statistics Norway

In the next stage, we assess how the consumption ratio reacts to a shock that increases income growth. We assume that quarterly growth in disposable income increases by 1 percentage point in 2018 before falling back to average growth in 2019. The positive shock reduces the consumption ratio to 89 percent at the end of 2018 because income elasticity in the model is 0.51 percent. A one percentage point increase in income growth thus leads to an increase in consumption growth of just half a percent. This is in line with consumption theories that suggest that variations in current income have a limited effect on consumption. After 2018, the consumption ratio moves to a level of around 90 percent, almost two percentage points lower than the equilibrium level in the simulation without income shocks. The explanation for the difference in the equilibrium level in the two simulations may be that while growth in consumption and income after 2018 is the same in the two simulations, the income shock has resulted in a persistently higher path for income.

Consumption equations with explanatory variables that generally vary with the business cycle will encounter problems in explaining changes in consumption that are the result of structural changes. Information about structural changes that influence the equilibrium level of consumption is therefore important to be able to estimate the impulse from household demand and the effect of monetary policy.

Of the driving forces discussed in Section 5, the estimated model only contains effects of changes in credit standards. The other effects are not included in the estimated model because each individual effect is not significant across the estimation period.[47] However, these driving forces may have had a considerable effect in combination. In this section, we compare the long-run equilibrium level in our model with historical averages and estimated effects of the driving forces in Section 5.

8.1 Historical averages and structural changes in Norway

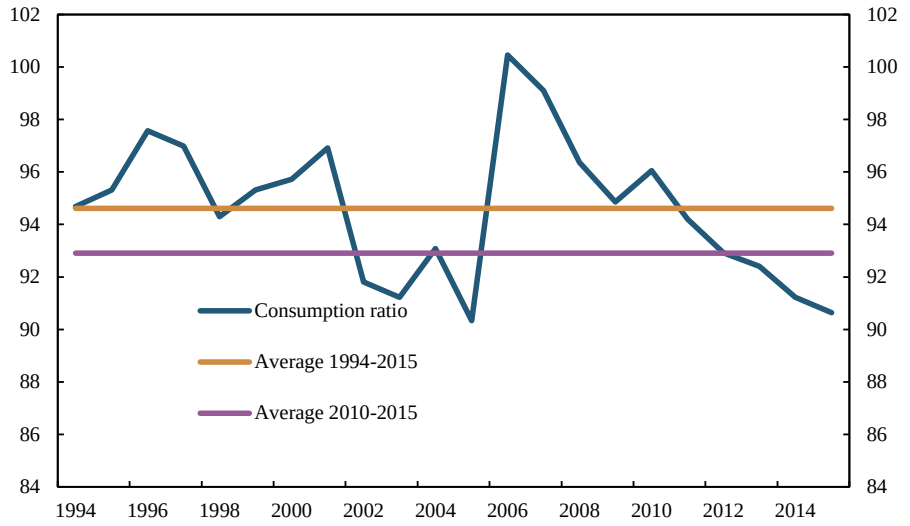
Historical averages may also provide indications of the long-run equilibrium level of the consumption ratio. The average for the period 1978-2015 was 96 percent. Structural changes, such as credit market deregulation in the 1980s[48] and the 1992 tax reform[49], may have made earlier periods less representative of today's equilibrium level for the consumption ratio. This suggests that the consumption ratio should be assessed over a shorter period. Over the estimation period of our model, 1994-2015, the average consumption ratio was just below 95 percent (Chart 21). The consumption ratio has, however, shown a falling trend through the period, averaging 93 percent since the financial crisis.

[47] We do not model the structural changes using dummy variables (variables that take the value 1 or 0) because these structural changes have an effect at so many different points in time.

[48] The additional reserve requirement, which had restrained growth in bank credit, was discontinued in January 1984. A system of interest rate declarations by the authorities, which set a ceiling on average bank lending rates, was discontinued in September 1985. These structural changes altered the relationship between consumption and a number of other key variables.

[49] Tax rates were cut substantially under the 1992 tax reform, but the tax base was broadened and a number of tax deductions were removed or reduced. The Norwegian tax system had high formal tax rates and extensive deduction rules before the 1992 reform. The deduction for interest on debt in particular resulted in substantial tax deductions, and high-income households could become a net zero taxpayer by raising large loans.

Chart 21. Ratio of consumption to disposable income[1)]. Constant prices. Four-quarter moving average. Percent. 1978 Q3 – 2015 Q4



1) Disposable income adjusted for household pension funds
Source: Statistics Norway

In the model's estimation period, structural changes may have reduced the long-run equilibrium level of consumption. Our calculations in Section 5 indicate that these changes combined may have reduced the consumption ratio by 5 to 10 percentage points in the estimation period (Table 3). This suggests that the long-run equilibrium level for the ratio is closer to 90 percent.

Table 3 Decomposition of changes in consumption ratio, in percentage points

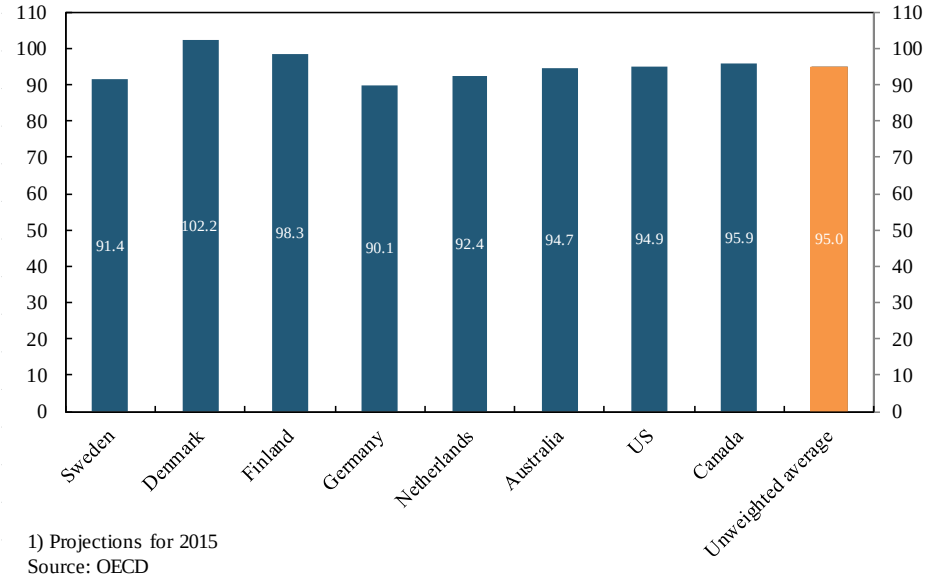
Effect of structural changes	1994 – 2015	2011 – 2015
- Demography – age composition	-2½ – -5	0 – ¼
- Demography – immigration	-½ – -¾	-¾ – -1¼
- Income developments for different age groups	-1 – -1¾	0
- Pension reform	-1½– -3	-1½ – -3
- Credit standards	0 – -¼	0 – -¼
- BSU (Youth home equity savings plan)	0 – -¼	0 – -¼
Total effect of structural changes	-5½ – -10¾	-2 – -4¼
Average consumption ratio	94.6	92.9
Long-run equilibrium level in 2015 adjusted for structural changes[50]	88½ – 91½	89¾ – 91¼

8.2 Historical averages for other comparable countries

It is also useful to compare the calculated equilibrium levels with historical averages for other countries, even though structural changes may also have changed consumption ratios in these countries. Chart 22 shows average household consumption ratios in eight comparable countries over the period 1994-2014, i.e. in our model's estimation period. The ratios vary from 90 percent in Germany to 102 percent in Denmark. The variation across countries may reflect factors such as differences in age composition, pension systems and tax systems and the figures are therefore not necessarily comparable. Average consumption ratios in other comparable countries can nonetheless provide an indication of what a long-run equilibrium level for Norway could be. The unweighted average for the eight countries in Chart 22 is 95 percent. This is in line with the calculated equilibrium levels in Section 8.1.

[50] The calculated long-run equilibrium is adjusted for the effect structural changes have already had on the average for the period.

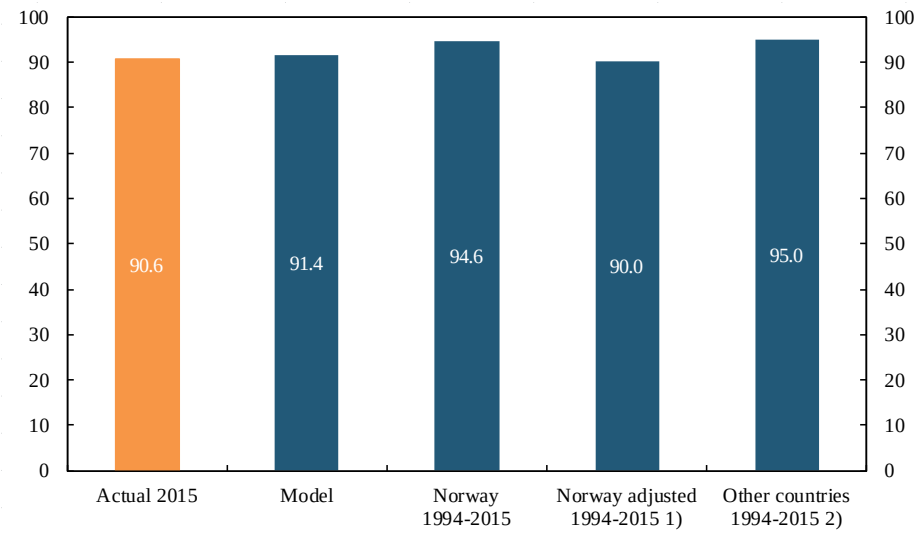
Chart 22. Ratio of consumption to disposable income in selected countries. Percent. Average for the period 1994 – 2015[1)]



1) Projections for 2015
Source: OECD

The averages indicate that the long-run equilibrium level of the consumption ratio is between 90 and 95 percent (Chart 23). In 2015, the ratio was 90.6 percent, well below the average for the period back to 1994 of 94.6 percent. Structural changes have probably reduced the equilibrium level somewhat in recent decades. Overall, this indicates that the consumption ratio may increase by 1-2 percentage points from today's level when fundamental factors normalise.

Chart 23. Calculated long-run equilibrium level of the ratio of consumption to disposable income based on different approaches. Percent



1) Adjusted for structural changes in the period
2) Australia, Canada, Denmark, Finland, Netherlands, Sweden, Germany and US
Sources: Norges Bank, OECD and Statistics Norway

9. Conclusion

Growth in household consumption has been weak since the financial crisis. Consumption as a share of household income (consumption ratio) has fallen by more than 4 percentage points since 2009. Growth is weak both in a historical context and in comparison with other countries. In recent years, growth in consumption has also been lower than can be explained by traditional consumption equations. In this article, we analyse the main driving forces behind household consumption in Norway.

Our consumption model, estimated over the period 1994-2015, combines insight from traditional consumption models with newer theories. Our estimation suggests that the main driving forces behind developments in consumption in Norway are household disposable income and wealth, and house prices, interest rates, access to credit, consumer confidence and economic uncertainty. The effect of interest rate changes are captured by two variables in the model. The income effect is included in household disposable income, while the substitution effect is captured by a separate interest rate variable.

Consumption growth is well explained by the model. The modelling shows that the decrease in interest rates has supported the level of consumption since the financial crisis. According to the model, consumption since the financial crisis has been constrained by limited access to credit, lower consumer confidence and heightened uncertainty with regard to economic developments.

Consumption equations with explanatory variables that generally vary with the business cycle will encounter problems in explaining changes in consumption that are the result of structural changes. Simple calculations show that consumption has been constrained by a number of structural changes since the financial crisis, including the 2011 pension reform and demographic changes. These changes will probably have a lasting negative effect on consumption.

The average consumption ratio in the model's estimation period is just below 95 percent, while the ratio was over 90 percent in 2015. Our calculations suggest that consumption will account for between 90 and 95 percent of disposable income in a long-run equilibrium. Historical averages for other countries correspond with this level. Overall, this suggests that the consumption ratio may increase by 1-2 percentage points from today's level when cyclical conditions normalise.

10. References

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Appendix

Table A1

Consumption	Consumption in mainland Norway. 1978 Q1 – 2015 Q4. Fixed prices. Quarterly data. NOK.
Unemployed	Unemployed as percentage of labour force. Norwegian Labour and Welfare Administration (NAV). Seasonally adjusted. 1978 Q1 – 2015 Q4.
Terms of trade	Export deflator relative to import deflator. Smoothed with two-sided HP filter with lambda=1600. Seasonally adjusted. 1978 Q1 – 2015 Q4.
Disposable income	Disposable income for households and non-profit organisastions excluding dividend income. 1978 Q1 – 2015 Q4. Yearly data to 2001. Quarterly data from 2002. NOK.
Income for lowest-income households	Income for the two lowest household income deciles.[51] 1987 – 2013. Yearly data converted to quarterly.
Income for different age groups	Income for different age groups[52]. Measured as a share of total income. 1987 – 2013. Yearly data converted to quarterly.
Income inequality	Standard deviations in income for the different income deciles. Normalised by mean income growth. 1987 – 2013. Yearly data converted to quarterly.
Size of the average household	Number of people in the average household. 1987 – 2013. Yearly data converted to quarterly.
Share of persons in different age groups	Share of persons aged 45-54, 55-66 and 50-66. Yearly data converted to quarterly.
Share of middle aged	Number of persons aged 50-66 as a share of number of persons aged 20-49 and 67 or older. 1987 – 2013. Yearly data converted to quarterly.
Financial wealth	Household financial wealth. Deflated by the consumption deflator. 1978 Q1 – 2015 Q3. FINSE from 1995.
Debt	Household debt. Deflated by the consumption deflator. 1978 Q1 – 2015 Q3. FINSE from 1995.
Housing wealth	Growth in existing housing wealth set equal to growth in house prices. Value of new housing wealth (change in housing volume) set equal to construction costs. Value of housing wealth in 2010 – 2014 is then set equal to Statistics Norway's estimate for the calculated market value of primary and secondary residences in 2010 – 2014.

[51] Measured as a share of total income and average income.
[52] 55-66, 60-66, 55-76 and 67-76 years old.

Lending rate	Interest rate on loans from banks and covered bond mortgage companies. Quarterly data. 1986 Q1 – 2015 Q4.[53] Percent.
House prices	Chained from different sources (Statistics Norway, Eiendom Norge, Eiendomsverdi, Finn.no and Norges Bank) and converted to quarterly data. 1978 Q1 – 2015 Q4.
Stock prices	Oslo Stock Exchange Benchmark Index (OSEBX). January 1996 – December 2015. Monthly data converted to quarterly. Index.
Oil price	Brent Blend. Quarterly data. 1960 Q4 – 2015 Q4. USD per barrel. We have attempted to estimate the model on the data series, as well as one-sided and two-sided HP filters of the data series.
Uncertainty index	Number of times certain words have been used in news items in Norwegian media.[54] 1978 Q1 – 2015 Q4. Monthly data converted to quarterly. Index.[55]
VIX Index	CBOE, Volatility Index (VIX).[56] 1990 Q2 – 2015 Q4. Index.
Volatility in stock prices	Standard deviations in daily returns on Oslo Stock Exchange Benchmark Index. Daily data converted to quarterly.[57] 1983 Q1 – 2015 Q4
Forward premiums	Deviation between ten-year government bond yields and three-month NIBOR. 1986 Q1 – 2015 Q4. Daily data converted to quarterly. Percent.
Expectations for own financial position	TNS Gallup. Own financial position next year. 1992 Q3 – 2015 Q4. Seasonally adjusted quarterly data. Expectation survey for consumers. Index.
Expectations for Norwegian economy	TNS Gallup. Norwegian economy next year. 1992 Q3 – 2015 Q4. Seasonally adjusted quarterly data. Expectation survey for consumers. Index.
Households' overall expectations	TNS Gallup. Norwegian economy next year. 1992 Q3 – 2015 Q4. Seasonally adjusted quarterly data. Expectation survey for consumers. Index.
Change in credit standards next three months	Survey of Bank Lending. 2007 Q4 – 2015 Q4. Quarterly data. Index.
Change in credit standards past three months	Survey of Bank Lending. 2007 Q4 – 2015 Q4. Quarterly data. Index.
Credit growth	Quarterly growth and twelve-month growth in domestic credit (C2) to households. 1975 Q4 – 2015 Q4. Quarterly data. Percent.

[53] Before 2002 Q1, banks' average lending rate on all loans is used to approximate the lending rate to enterprises from banks and covered bond mortgage companies.
[54] Different uncertainty indices have been constructed and tested on the basis of the words "økonomi" (economy), "usikkerhet" (uncertainty), "krise" (crisis), "oppsigelse" (resignation) and "svekke" (weaken).
[55] The index is constructed using data from Retriever, a Nordic supplier of media monitoring. The index is normalised by the number of times the words "og" (and) and "er" (is) were used in the same news items in Norwegian media.
[56] The VIX Index is based on derivatives that measure expected volatility in the US financial market over the next 30 days.
[57] Standard deviations measured over the past 90 days.

Share of households with a high debt ratio	Share of households with a debt ratio[58] of more than 500 percent. 1987 – 2013.Yearly data converted to quarterly. Percent
Increase in household interest burden when the interest rate increases by one percentage point	Increase in household interest burden[59] when the interest rate increases by one percentage point. 1987 – 2013. Yearly data converted to quarterly. Percentage points.
Household interest burden when the interest rate increases by three percentage points	Household interest burden when the interest rate increases by three percentage points.1987 Q1 – 2014 Q4.Quarterly data. Percent.
Debt servicing ratio	Household debt and instalment payments as a share of disposable income after tax.[60] 1980 Q1 – 2014 Q4. Quarterly data.
Share home equity lines of credit	Home equity lines of credit as share of total housing mortgages. All banks and covered bond mortgage companies. 1987 Q1 – 2015 Q4. Quarterly data. NOK.
Lending margin	Margin on loans from banks and covered bond mortgage companies. 1986 Q1 – 2015 Q4. Quarterly data. Percentage deviation between lending rate and three-month NIBOR.
Oil wealth	Present value of Norway's oil wealth. Sum of oil wealth in the ground and the Government Pension Fund Global. Yearly data 1996 – 2014, converted to quarterly.

[58] Loan debt as percentage of disposable income (all forms of income less taxes, interest expenses and other expenses).
[59] Total interest payments as percentage of total income after tax.
[60] Tax deductions for debt interests are deducted from the estimated interest payments. The maturity on household debt is set at 18 years for the entire period.

Table A2: Recursive estimates of the coefficients. 2009 Q1 – 2015 Q3. The estimations start in 1994 Q1

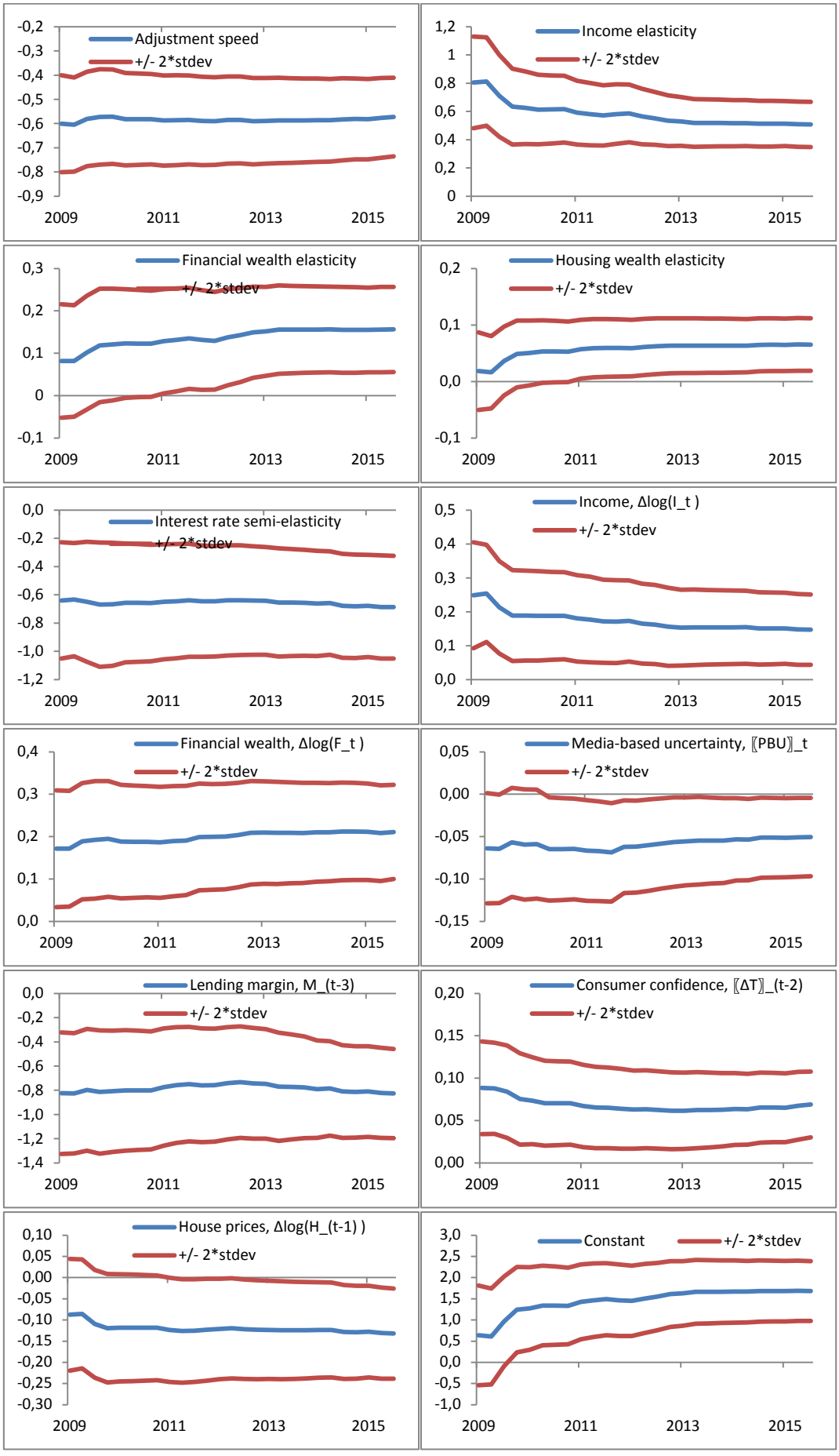

Table A3: Error term in one-step forecasts and one-step Chow-test