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Research Report

Ten Years of Household Micro Data. What Have We Learned?

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STAFF MEMO

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FINANCIAL STABILITY



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STAFF MEMO

**Ten years of household micro data.
What have we learned?[†]**

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MACROPRUDENTIAL UNIT, FINANCIAL STABILITY, NORGES BANK

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ABSTRACT

Administrative register data for Norwegian households are used to analyse the distribution of debt and assets by income, wealth and age group. We find that the cross-sectional distribution is skewed. The distribution of debt across age has changed over time, with more of the debt being held by older households and less by younger ones. A birth-cohort study shows that households in later cohorts have more real debt than households in earlier cohorts when we compare the same life-cycle phase. Credit risk is evaluated using a number of measures and criteria. The overall conclusion is that the share of risky debt is small, but the share may increase significantly if interest rates climb to higher levels or house prices fall.

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1 Introduction

Norwegian households' indebtedness has grown sharply for a long period. The aggregate household debt-to-disposable income ratio increased by about 85 percentage points from 1997 to 2013, reaching close to 200 per cent.¹

There is a growing literature that analyses the link between excessive credit and financial crises, see for example Drehmann et al. (2011), Reinhart and Rogoff (2009), and references therein. For evidence from Norwegian data, see Norges Bank (2013) and Riiser (2005). This literature finds that high credit growth can signal financial instability and banking crises.

Aggregate data may mask financial stability risk if the distribution of debt, income and assets are skewed across households. To more precisely understand the sustainability of household debt, the distribution of debt across debt holders, their debt servicing ability and shock resistance must be assessed. This paper draws on the last 10 years of analyses using administrative register household data at Norges Bank.²

The main findings of the paper are that households' total assets are almost three times total debt. Dwellings are, by far, the most important asset. Assets and debt grew steeply in the 2000s, but debt more than assets. A large share of the increase in debt is by homeowners that do not change dwelling. The mean level of assets and debt vary widely across households. Most of household debt is held by households in the late twenties to the mid-fifties. In the 2000s, the distribution of debt has shifted from younger to older households. This shift can partly be explained by demographic changes, but an increase in mean debt dominates. The distribution of debt by both income and total

¹In this period, loan interest rates have on average been low, growth in house prices has been high and the availability of housing equity withdrawal has improved. Hence, in combination with high income growth, high credit growth is as expected. See for example Jacobsen and Naug (2004), Anundsen and Jansen (2011) and Akram (2012).

²An increasing number of central banks supplement their analyses of household debt on aggregate data with analyses using household-level data. In the Scandinavian countries, administrative register data are extensively used in the analyses of household debt. For examples regarding Denmark and Sweden, see Andersen et al. (2014) and Winstrand and Ölcer (2014) respectively. Survey-based data are applied by numerous central banks: By the Bank of Canada, see Crawford and Faruqui (2012); by the Reserve Bank of Australia, see Bilston and Rodgers (2013); by the Bank of England, see Bunn et al. (2012); and by a number of euro-area countries, see Eurosystem Household Finance and Consumption Network (2009) and Bover et al. (2013).

assets is skewed, by financial assets the distribution is more even.

A birth-cohort analysis shows that later cohorts have more real debt than earlier cohorts at the same life-cycle phase, i.e. age. The same result prevails if we look at debt to income. Hence, later birth cohorts are more vulnerable to an increase in the loan interest rate and a decline in income. Credit risk is evaluated using a number of measures and criteria. The overall conclusion when applying a combined criterion is that credit risk is concentrated in a small share of the households and that these households hold a small share of total debt. Sensitivity analyses that evaluate the impact of an increase in the loan interest rate and a fall in house prices show that the increase in the share of risky debt can be significant, particularly in a twin-shock case.

The rest of this paper is structured as follows. Chapter 2 gives an overview of our data, while Chapter 3 presents stylised facts in households' balance sheet. In Chapter 4 we look in more detail at demographic changes and in Chapter 5 we present a cohort analysis. In Chapters 6 we present measures of risk and sensitivity analyses. We look at the impact on risk measures of negative shocks. Chapter 8 summarises and concludes. Descriptive statistics of the data are presented in Appendix A, while we in Appendix B provide a short review of analyses using the household-level data at Norges Bank.

2 The data

Our primary data source is Households' Income and Wealth Statistics from Statistics Norway, see Statistics Norway (2014) for details. The data are annual end-of-year observations.³

Our sample covers 1987-2012 and includes both the Norwegian banking crisis 1988-1993 and the financial crisis as from 2007. For the period 1987-2003, the data are based on the Income Distribution Survey, which is a representative sample survey based on tax return data. The number of households in the sample varies from 3000 at the beginning of the period to 20 000 at the end of the period.

From 2004, the statistics are based on administrative register data, as tax returns, that cover all Norwegian residents as of 31 December of the fiscal year. In addition to information on each

³The data show the status at 31 December each year of debt and wealth and accumulated income flows within the calendar year.

household's composition and the household members' age etc., the data include registered income, transfers, debt, wealth and tax payments.

The complete statistics of 2012 consist of 5 051 275 persons living in 2 417 045 households. We restrict our sample to wage earners and benefit recipients, i.e. to households where wages and benefits are the main source of income. For self-employed persons we are not able to separate out debt for business purposes from consumer and mortgage debt. Since our primary focus is on the two latter types of debt, households with main income from self-employment are excluded. Our reduced dataset consists of 4 767 503 (94 per cent of the full sample) living in 2 277 420 households.

The values of assets on the balance sheet are tax values that may deviate from market values. From 2010, Statistics Norway has estimated the market value of both primary and secondary dwellings of all Norwegian households, see Holiløkk and Solheim (2011) and Epland and Kirkeberg (2012) for a more thorough discussion. For holiday homes, cars and unregistered securities, tax values typically underestimate the market values.⁴ With respect to financial assets, unlisted papers are less liquid and can be difficult to value.

In addition to Households' Income and Wealth Statistics, we use the Standard Budget compiled by National Institute for Consumer Research to estimate the development of standard cost of consumption, see SIFO - National Institute for Consumer Research (2014).

Definition of important variables

- *Deposits* are total household bank deposits and cash.
- *Other financial assets* are shares, equities, bonds, unregistered securities and other taxable financial assets. Assets underlying pension-related payments and insurance claims are not part of taxable wealth and therefore not included in this measure of taxable financial wealth.
- *Financial wealth* is deposits and other financial assets.
- *Debt* is total household debt. In addition to loans from financial institutions, it includes

loans from housing cooperatives, limited-liability housing companies and jointly-owned housing properties. It also includes student loans from the Norwegian State Educational Loan Fund, Lånekassen.

- *Net debt* is defined by us as total household debt less bank deposits (incl. cash).
- *Net financial wealth* is financial wealth less debt.
- *Dwellings* are primary and secondary dwellings. Primary dwellings are owner-occupied housing, whereas secondary dwellings are other dwellings than holiday homes owned by the household.
- *Other real capital* are holiday homes, cars and boats etc.
- *Total assets* are financial wealth, dwellings and other real capital.
- *Net wealth* is total assets less debt.
- *After-tax income* is the sum of wages and salaries, income from self-employment, property income, interest income and transfers received, including pensions, less total assessed taxes and negative transfers.
- *Disposable income* is after-tax income less interest payments on debt.
- *Debt servicing income* is after-tax income less standard cost of consumption.
- *Financial margin* is after-tax income less interest expenses and standard cost of consumption.
- *Standard cost of consumption* is the cost of maintaining a reasonable level of consumption, it depends on family size. The budget contains both current expenses, such as food, clothing, toiletries, etc., and expenses for less frequent purchases, such as furniture and electrical appliances.
- A *household/private household* is defined as all persons who reside permanently in the same dwelling and have common housekeeping. Persons living in institutions are omitted. We also exclude self-employed households. These are defined as households whose main-income of the main-income earner is generated by self-employment.

⁴In Norway, the tax treatment of dwellings varies by three categories. A household may permanently reside in a primary or secondary dwelling. A holiday home can not be used as a permanent residence.

- The *main income earner* is the person in the household who has the highest gross income of the household members. If there is no income earner, the oldest person is defined as the main income earner.
- *Age* is the age (measured in years) of the main income earner of the household.

In the paper, we frequently divide the households into age and income groups. Age groups are based on the age of the main income earner, while the income groups are aggregates of after-tax income deciles. Data on after-tax income and total debt in these groups are provided in Appendix A.

3 Household balance sheet

3.1 The 2012 tax-return balance sheet

In 2012, the mean value of households' total taxable assets was NOK 2.9 million, see Figure 1a and the third column of Table 1. The estimated market value of dwellings amounted to nearly 70 per cent of households' total assets, see last column of Table 1. Primary dwellings, i.e. owner-occupied dwellings, were the far most valuable assets, and approximately two-thirds of all households reported living in a self-owned dwelling, see the second column of Table 1 and Figure 1b. The rest of real assets, such as holiday homes, cars and boats etc., are reported tax values that we expect to be below market values.

Financial assets amounted to 26 per cent of total assets. Around a half of this were bank deposits, see the fifth column of Table 1. Bank deposits are reported at actual value. The next largest class, one-third of financial assets, is unlisted securities, which includes ownership shares in own companies. Unlisted papers are generally not liquid and difficult to value. By subtracting debt from total assets, we obtain the net wealth, or equity, of the households. On average, households' equity ratio (equity-to-total assets) was 64 per cent, see last the column.

Assets and debt are unequally distributed across households, see Figure 1c. In this figure, households are ordered by increasing total assets and divided into 100 equal-sized groups.

Looking across age of the main income earner, we see that debt, assets and net wealth vary by age, see Figure 1d. Net wealth is highest among households in their late sixties. Both debt and housing wealth increase rapidly by age among younger households. Debt peaks among households in their

late thirties and thereafter decreases slowly towards zero. Housing wealth peaks among households in their late fifties and remains relatively high also among households in older age groups. Total financial assets are largest among households in their sixties. While other financial assets starts declining as from households in their fifties, deposits continue to grow and stay high among even older households. Hence, older households hold more liquid financial assets.

Net wealth of older households is on average high. In 2012, mean financial assets and total wealth among households at the age of 90 were NOK 750 000 and NOK 2 millions, respectively. A high degree of home ownership and high growth in house prices, coupled with low mortgage debt and high growth in pensions in later years are important explanations for high wealth among old households.

3.2 Housing wealth and housing market affiliation

The home-ownership share of households has grown modestly from 63 per cent in 1994 to 67 per cent in 2012, see Figure 1b. Among the oldest households, the home-ownership share has increased significantly, however. The distribution of housing wealth across age groups has changed over time, and more of the housing wealth is owned by older households and less by younger households, see Figure 1e. From Figure 1f it is evident that housing wealth increases in income.

Figure 2a shows that the overall average number of persons per household has been relatively stable in the 1990s and 2000s. There is a clear pyramid-shaped pattern across age, reflecting both a relatively high share of single-person households among the very young and old, and, in between the young and old, households with children living at home. The average household size has declined over time for younger households and increased somewhat among middle-age households. If we compare figures 1b, 1e and 1f, we see that all three show a pyramid-shaped pattern across age. Hence, the home-ownership share and the share of total housing wealth are positively related to household size. However, once the household has become a homeowner, it tends to remain a homeowner in its older age, also when children move out.

To evaluate households' housing market affiliation, we compare the housing value in household's tax return in two successive years. If a household

Table 1: Households' taxable balance sheet. 2012¹⁾

	Sum NOK billions	Share ¹⁾ with positive value Per cent	Mean		Share	
			All NOK 1000	Positive value ²⁾ NOK 1000	Asset class Per cent	Total Per cent
Primary dwellings	4 076	64	1 790	2 777	84	62
Secondary dwellings	469	10	206	2 074	10	7
Holiday homes	75	15	33	220	2	1
Other real property	89	13	39	304	2	1
Real property	4 708	71	2 067	2 896	97	72
Production capital	18	3	8	239	0	0
Consumption capital	138	52	60	116	3	2
Real capital	4 864	78	2 136	14 293	100	74
Bank deposits	815	99	358	362	49	12
Norwegian shares and equity certificates	67	14	29	210	4	1
Units in unit trusts	70	28	31	108	4	1
Securities not registered in a securities register	539	8	237	2 810	32	8
Bond funds and money market funds	18	6	8	131	1	0
Debt receivables	78	5	34	636	5	1
Other domestic financial assets	56	30	25	83	3	1
Financial assets abroad	28	5	12	273	2	0
Financial assets	1 671	99	734	742	100	26
Total assets	6 535	99	2 870	2 904		100
Debt	2 336	84	1 026	1 224		36
Equity	4 200	79	1 844	2 345		64
Debt & Equity	6 535	99	2 870	2 904		100

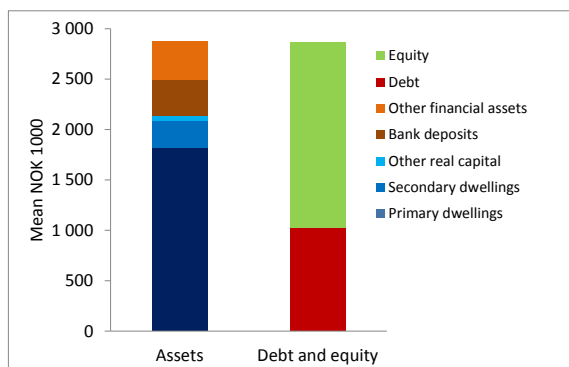
1) Share of households that report a positive value in the tax return.

2) Mean value across households that report a positive value in the tax return.

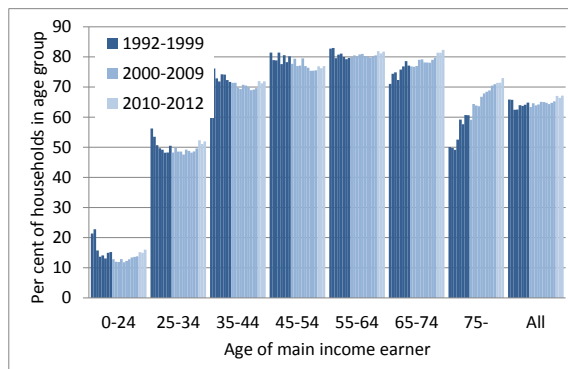
Sources: Statistics Norway and Norges Bank

Figure 1: Balance sheet. Panel I

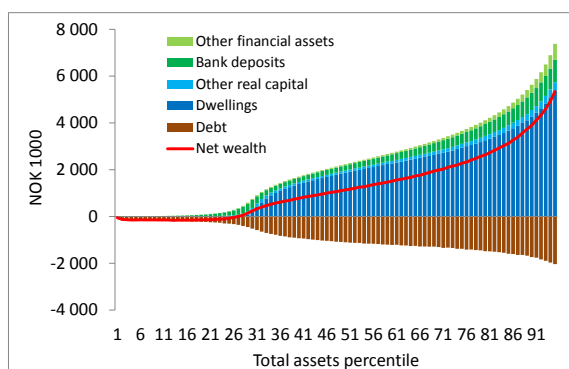
(a) Households' taxable balance sheet. Mean. 2012



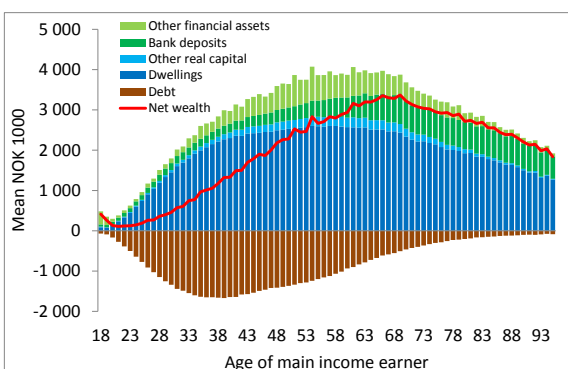
(b) Home-ownership share by age of main income earner. Per cent. 1992-2012



(c) Assets, debt and net wealth by total assets percentile. Percentile 1-95¹⁾. Mean. 2012



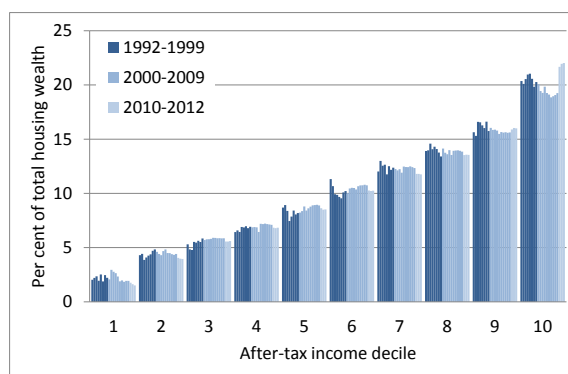
(d) Assets, debt and net wealth by age. 18-95 years. Mean. 2012



(e) Distribution of housing wealth by age of main income earner. Per cent. 1992-2012



(f) Distribution of housing wealth by after-tax income decile. Per cent. 1992-2012



1) Truncated for graphical reasons. Mean net wealth for percentile 100 is NOK 32 millions.
Sources: Statistics Norway and Norges Bank

has no taxable housing wealth in both years, it is classified as a renter. If the housing tax-value changes from zero to a positive number from one year to the next, it is classified as a first-time home buyer. If the tax value changes in accordance with the rule defined by the tax authorities, the household is classified as living in the same dwelling. The rest, including homeowners that change dwelling, are sorted in "Other homeowners". Around 30 per cent of the households are renters, see Figure 2b. A little less than 60 per cent stay in the same dwelling, and approximately 11 per cent of the households are either first-time buyers or movers.

3.3 Distribution of financial assets

Table 1 shows that deposits were approximately half of households' taxable financial assets in 2012. Households may hold deposits both for transaction and savings purposes. As we can see from Figures 2c and 2e, both deposits and other financial assets vary across age. In general, deposits increase by age, and the households with a main income earner above 65 hold around 40 per cent of total deposits. Other financial assets increase by age up to households in their fifties.

Except for the very highest and lowest income-decile groups, deposits are relatively evenly distributed over income groups, see Figure 2d. The same is true for other financial assets, see Figure 2f. The spike in the lowest after-tax income decile reflects wealthy, low after-tax income households.

3.4 Distribution of debt

In 2012, approximately 16 per cent of the households had no registered debt, see Figure 3a, blue column to the left. Approximately 50 per cent of the households had debt that was less than NOK 500 000. The mean after-tax income of households with debt this year was a little more than NOK half million. The other half of households held 95 per cent of debt. Hence, a large share of Norwegian households have little debt, and the bulk of household debt is held by households with a relatively high level of debt.

The distribution of household debt is pyramid-shaped across age groups, see Figure 3b. Considerable debt is held by households within the primary first-time home buyer and second stepper households, i.e. age groups 25-34 and 35-44. Over time, the distribution of debt across age groups has

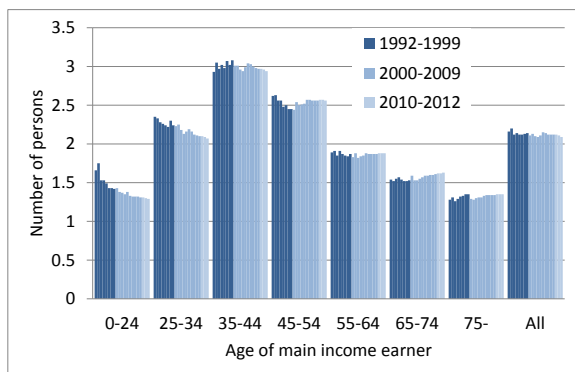
changed. Debt has shifted from younger to older households, and particularly age group 55-64 years stands out with an increasing share of total debt.

High income households hold more debt than low income households, see Figure 3c. In the 2000s, the distribution of debt by after-tax income deciles has been stable. Due to tax reforms that made it less favourable for high income groups to hold debt, the richest households reduced their debt in the 1990s. In Figure 3d we look at the distribution of debt across both after-tax income and age. For the age groups 35-64, about two-thirds of the debt is held by households within the highest income deciles. About one-third of the debt is held by households within the medium income deciles. The debt held by households in the age groups 25-34 and 65-74 is approximately equally distributed across income deciles 8-10 and 4-7 respectively.

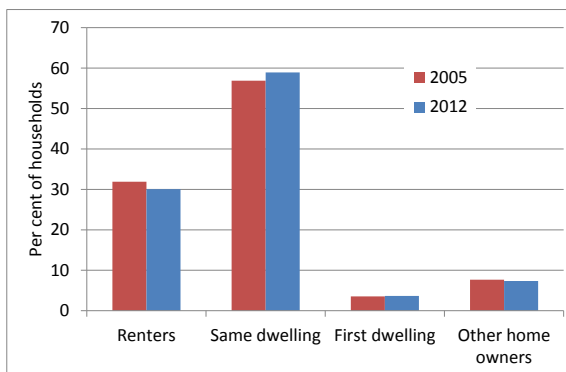
The distribution of debt by financial asset decile is more even than by income decile, see Figure 3e. However, in the 2000s, the share of debt held by the low financial-asset groups has declined, while the share has increased among households with relatively high financial assets. The distribution of debt by total assets is skewed, and debt increases with total assets, see Figure 3f. The 20 per cent wealthiest households hold close to 40 per cent of household debt.

Figure 2: Balance sheet. Panel II

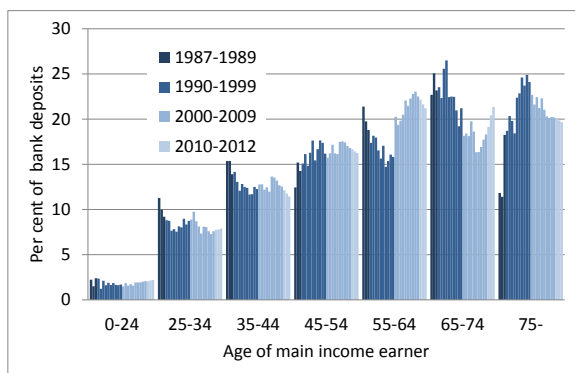
(a) Household size in number of persons by age. 1992-2012



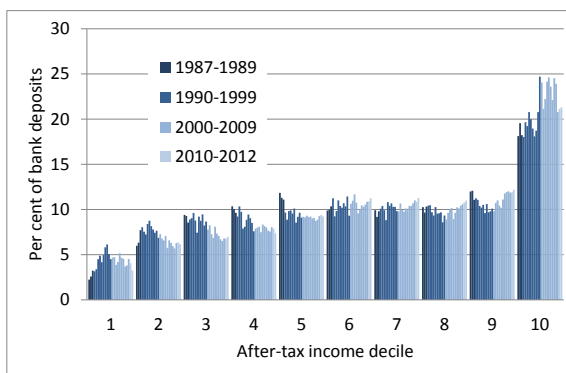
(b) Distribution of households by housing market affiliation. 2005 and 2012



(c) Distribution of bank deposits by age. 1987-2012



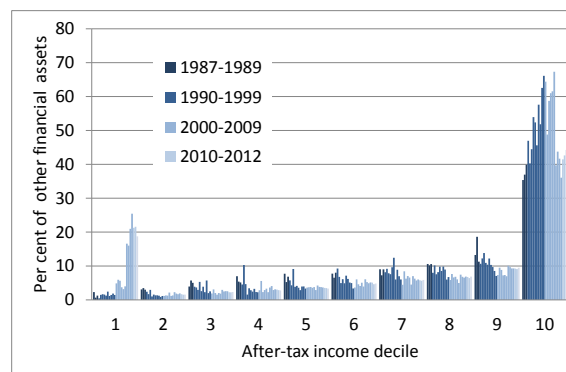
(d) Distribution of bank deposits by income decile. 1987-2012



(e) Distribution of other financial assets by age. 1987-2012



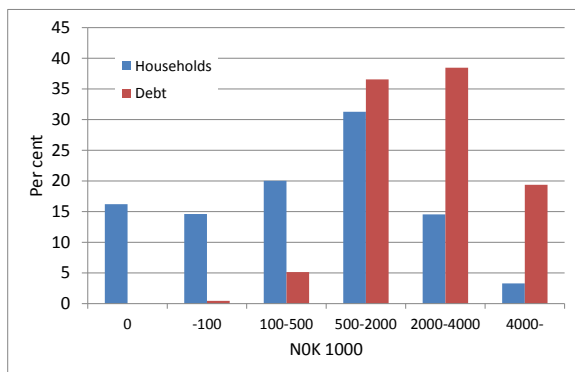
(f) Distribution of other financial assets by income decile. 1987-2012



Sources: Statistics Norway and Norges Bank

Figure 3: Balance sheet. Panel III

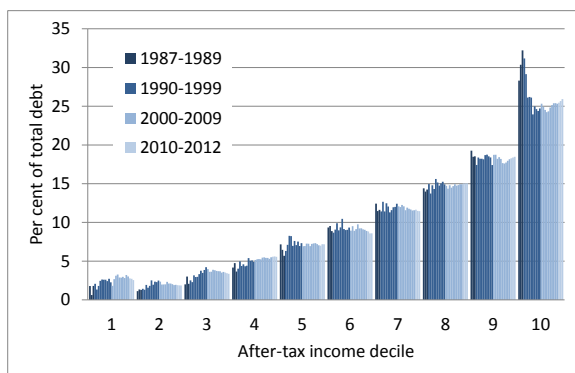
(a) Distribution of households and debt by size of debt. 2012



(b) Distribution of debt by age. 1987-2012



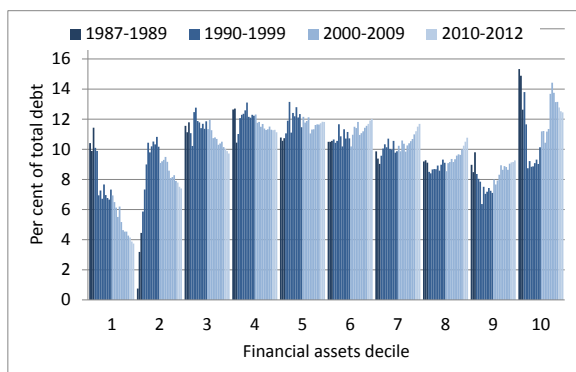
(c) Distribution of debt by after-tax income decile. 1987-2012



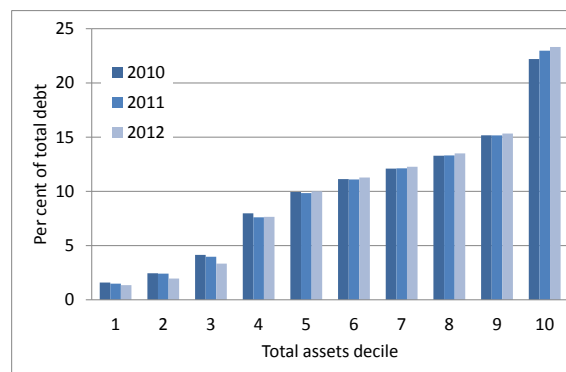
(d) Distribution of debt by after-tax income decile group and age. 2012



(e) Distribution of debt by financial assets decile. 1987-2012



(f) Distribution of debt by total assets decile. 2010-2012



Sources: Statistics Norway and Norges Bank

4 Debt accumulation of Norwegian households

4.1 Demographic effects and changes in debt

We will now take a closer look at the shift over time in the distribution of household debt from younger to older households, as shown in Figure 3b. Our main focus is on the development in the 2000s. The shift in debt is a result of a combination of demographic changes, i.e. a shift in the distribution of households across age groups, a shift in the share of households holding debt within each age group, or a change in mean debt within each age group.

Both the increase in the share of households in age group 55-64 and the decrease in the share of households in age group 25-34 are consistent with the corresponding increase and decrease in share of household debt for these groups, see Figure 4a.

The overall share of households with debt increased from 72 to 84 per cent from 1987 to 2012. The increase was particularly large among older households, see Figure 4b. Among the young and middle-aged households, the share with debt is high in all years of our dataset. From the mid-nineties, i.e. beyond the aftermath of the Norwegian banking crisis, mean debt increased for all age groups, see Figure 4c. Measured in NOK, the increase was largest for the age groups with the highest level of debt initially. Measured as a change in per cent, the increase was highest for older households with relatively little debt initially.

In Figure 4d we control for the demographic effect to identify the importance of the non-demographic factors discussed above, i.e. the share of households with debt and the level of debt of those with debt. We find that the non-demographic factors, like the demographic factor, push down the share of debt held by age group 25-34 and increase the share of debt held by age group 55-64.

To better understand the importance of the factors discussed above for the growth in debt, we decompose growth from 2000 to 2012 into demographic and the non-demographic effects. Since age group 55-64 has increased its share of debt significantly in the 2000s, we also decompose the growth in debt for this group. The results are shown in Table 2.

Total household debt increased by more than 140 per cent in real terms from 2000 to 2012. Both an increase in the number of households and the share of households with debt contributed, but the

far most important effect is a higher level of real debt among those with debt. Mean debt among indebted households almost doubled over this 12-years period. Within age group 55-64, debt grew by approximately 280 per cent. Mean debt among those with debt grew by more than 130 per cent, but also an increase in the number of households and the share of households with debt contributed significantly to the increase in debt. Our overall conclusion is that demographic changes are important for the observed growth in debt, but non-demographic effects dominate.

Table 2: Decomposition of the growth in debt over 2000-2012. All private households and households in age group 55-64

	2000	2012	2012 /2000
All households			
Total debt, NOK billions ¹⁾	767	1875	2.4
No. of households, 1000	1995	2277	1.1
Share with debt, per cent	76	84	1.1
Mean debt of households with debt, NOK 1000 ¹⁾	503	983	2.0
Product			2.4
Age group 55-64			
Total debt, NOK billions ¹⁾	72	273	3.8
No. of households, 1000	246	347	1.4
Share with debt, per cent	77	90	1.2
Mean debt of households with debt, NOK 1000 ¹⁾	378	876	2.3
Product			3.8

1) Deflated by CPI, 2000-prices.

Sources: Statistics Norway and Norges Bank

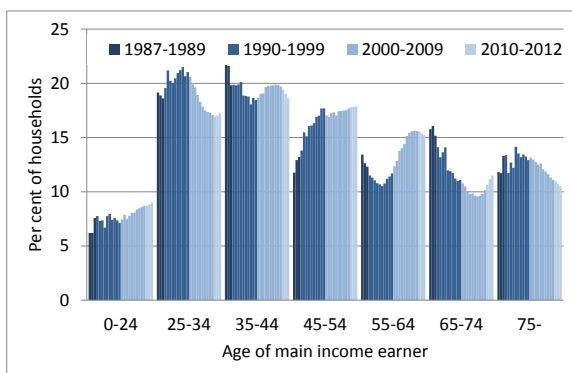
4.2 New loans and down payments

Although many households increase their debt, many also pay off debt. This is true for all age groups. To gain a better understanding of the heterogeneity in households' debt holding and accumulation, we evaluate the change in debt from 2011 to 2012 in detail. In Table 3, we split the households according to whether they increased or decreased their debt from the end of 2011 to the end of 2012.

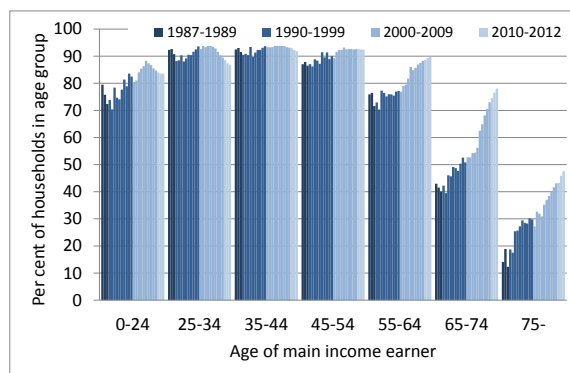
We find that 42 per cent of the households increased their level of debt by on average 28 per

Figure 4: Demographic effect and debt accumulation by age of main income earner. 1987-2012

(a) Distribution of households



(b) Share of households with debt



(c) Mean real debt. In 2000-prices

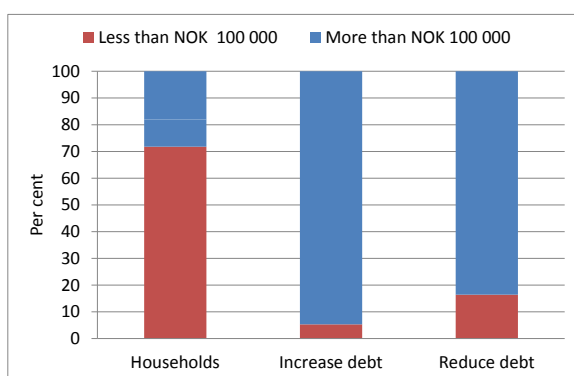


(d) Distribution of debt adjusted for demographic changes



Figure 5: Change in household debt

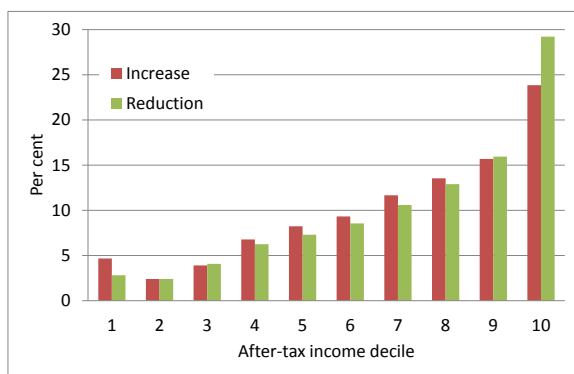
(a) Distribution of households, increase in debt and reduction in debt by size of change in debt. 2011-2012



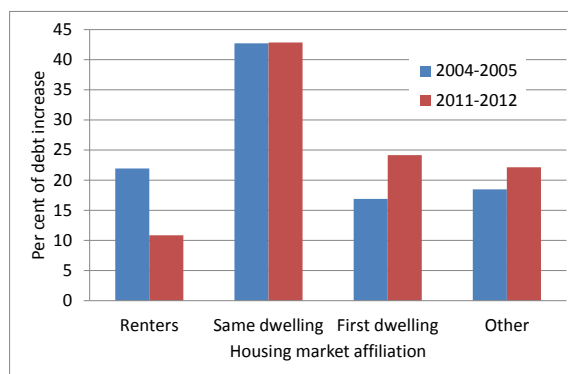
(b) Distribution of change in debt by age. 2011-2012



(c) Distribution of change in debt by income decile. 2011-2012



(d) Distribution of increase in debt by housing market affiliation. 2004-2005 and 2011-2012



Sources: Statistics Norway and Norges Bank

Table 3: Increase and reduction in household debt from 2011 to 2012¹⁾

	With no debt	Increases debt	Reduces debt	All households
Households (in 1000)	292	961	1 025	2 277
Households (per cent of all)	13	42	45	100
Initial total debt (NOK billions)	0	1 188	975	2 164
Change in total debt (NOK billions)	0	330	-154	176
Change in mean debt (NOK 1000)	0	344	-150	77
Growth in mean debt (per cent)	0	28	-16	8

1) Measured at 31 December each year.

Sources: Statistics Norway and Norges Bank

cent. At the same time, 45 per cent of the households reduced their level of debt by 16 per cent on average. The remaining households have no debt, neither at the end of 2011 or 2012.

More than 70 per cent of the households change their debt by less than NOK \pm 100 000, see the first pillar of Figure 5a. The second and third pillars show how the gross increase and decrease in debt are distributed according to the size of change. Pillar two shows that as much as 95 per cent of the gross increase in debt is by households that increase debt by more than NOK 100 000. These households' share of all households is rather small, only 18 per cent. At the same time, 16 per cent of the households reduce their debt by more than NOK 100 000. This is 84 per cent of total down payments, see pillar three.

As expected, the change in debt follows a clear age profile, see Figure 5b. Age groups 24-34 and 35-44 account for most of the increase in the level of household debt. The latter age group also has the largest share of down payments. The large down payments of age group 35-44 are probably related to the high level of debt of this group, cease of interest-only period and a pyramid-shaped income profile across age groups. There is a strong connection between change in debt and income, see Figure 5c. Around 40 per cent of both debt increase and down payments can be found in the two highest income deciles.

In 2012, around 11 per cent of the increase in debt is for households that do not own a dwelling, see Figure 5d. Compared with 2005, this fraction was more than halved. Nearly one-fourth of the increase in debt in 2012 is for first-time home buyers and around 20 per cent for households that change dwelling. More than 40 per cent of the increase in debt is for households that remain in the same dwelling.

5 Birth-cohort analysis

In previous chapters we evaluated the distribution and development of household debt across different household groups, such as age groups. Our household-level data enable us to apply a birth-cohort approach and to consistently evaluate the evolution of household assets and debt over the life-cycle.⁵ A birth-cohort consists of households with a main income earner of the same birth year. The oldest cohort in our birth-cohort sample is 95 in 1987, i.e. the main income earner is born in 1892, and the youngest cohort in our sample is 25 in 2012, i.e. the main income earner is born in 1987. All cohorts in between 1892 and 1987 are included in the birth-cohort sample.

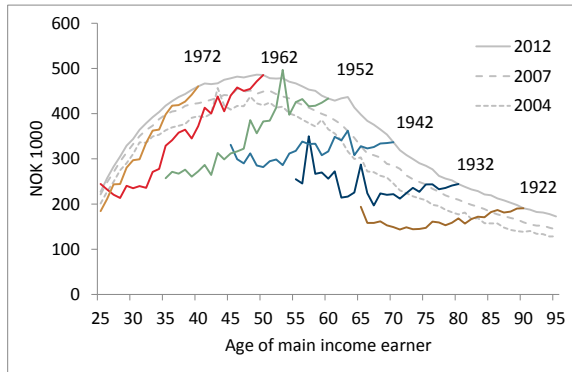
To support our discussion, we present graphs that enable us to highlight the development over the life-cycle of a limited number of cohorts in addition to show the profile each year across all cohorts. We truncate our data at age 25 and 95, i.e. we do not display the results when the main income earner is below 25 or above 95. The oldest cohort we highlight is born in 1922 and is 65 in 1987 and 90 in 2012. The youngest cohort we highlight is born in 1972, it is 25 in 1997 and 40 in 2012.

We start by showing the mean, i.e. per household, real after-tax income, see Figure 6a. The solid and dotted grey lines in each graph show the cross-sectional distribution in three calendar years. For example the 2012-solid line shows the real after-tax income across all cohorts this year, and the age of the main income earner depends on the year of birth. The coloured lines trace the development of six specific cohorts over time, i.e. the part of these cohorts' life-span that is covered by

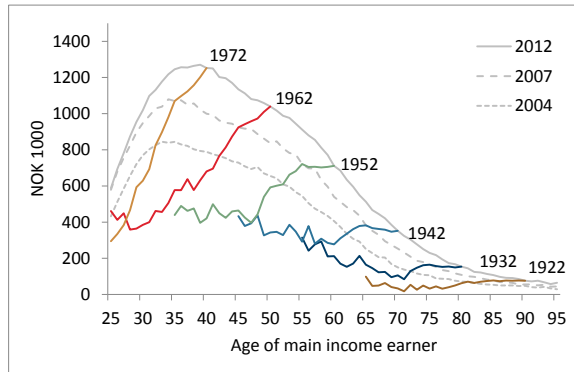
⁵Analyses of household saving and debt often take the life-cycle hypothesis (LCH) as a starting point. This theory, which was first presented in Modigliani and Brumberg (1954), provides a framework for analysing household spending and saving behaviour over the life-cycle.

Figure 6: Cohort analysis, 1987-2012. By age and birth year of main income earner. Mean. 2000-prices

(a) After-tax income



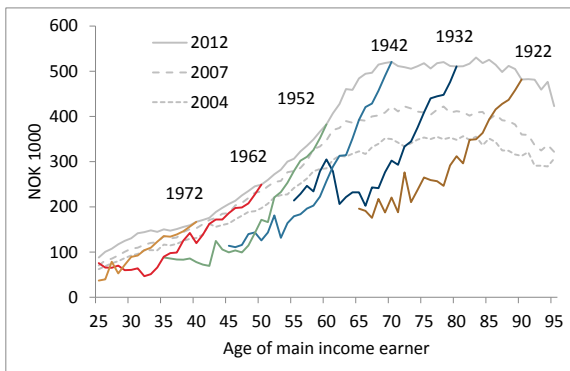
(b) Debt



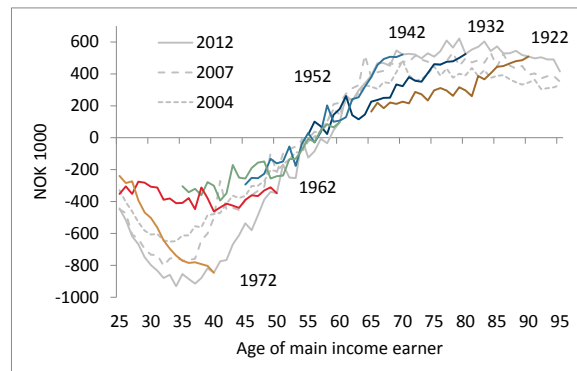
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(c) Deposits



(d) Net financial assets



For a dynamic version of the figure click [here](#)

For a dynamic version of the figure click [here](#)

Sources: Statistics Norway and Norges Bank

our data.

Looking across the same life-cycle period, i.e. age, of our six selected cohorts, it is clear that mean real income in general has grown over time. Later cohorts have higher real income than earlier cohorts. Concentrating on the cohort profiles, we see that real income tends to increase most in the earlier life-phases of a cohort and declines or flattens out as the households enter their sixties, which is also the normal retirement age. The cohorts experienced low, or even negative, income growth in the late 1980s and early 1990s. This is related to the severe Norwegian economic downturn at that time. Real income growth has been high in the 2000s. This is true also for pensions, which to a large degree have been linked to wage growth for manufacturing workers. Real income among cohorts in their pensioner phase shows renewed growth in the 2000s.

Figure 6b shows the development in mean real debt. Looking across the cohorts, we see that real debt at the same life-cycle period, i.e. age, increases from earlier to later cohorts. This is particularly true in the the 2000s, and there is a sharp shift upwards in the grey curves. However, the growth in debt is broadly leveling off when the financial crisis erupts.

To discuss the borrowing and pay-off behaviour of households within the birth-cohort framework, we must look at the development in the level of mean debt over the life-cycle of each cohort. The earliest cohorts pay their debt up until the 2000s. The strong increase in real debt in the 2000s of the majority of the cohorts may signal a change in the attitude of holding debt coupled with an increase in the availability of credit.

We now turn to household savings in real deposits and real net financial wealth. From Fig-

ure 6c we see that our earliest cohorts continue to build up real deposits towards the end of their life-cycle. There is a tendency among households in these early cohorts to reduce their deposits in their sixties, but this is more than offset in their seventies. This increase in deposits among the earliest cohorts is in line with the shift in the composition of financial assets that we found in Figure 1d. There we saw a shift from other financial assets to the most liquid and safe financial asset, i.e. deposits, among older households.

Figure 6d shows household real net financial wealth.⁶ The broad picture is that households born prior to the mid-fifties go from having negative to positive real net financial wealth around their mid-fifties. We now concentrate on the life-cycle period with negative net financial wealth. By comparing the grey curves, we see that there is a clear negative shift in households' wealth position between earlier cohorts and those born after the mid-sixties. However, later cohorts have a longer life expectancy and, due to pension reforms⁷, a higher expected retirement age. This may affect the down-payment profile. Moving to the life-cycle period with positive real net financial wealth, we see that later cohorts have more net wealth than earlier cohorts when we compare across the same age. Hence, the cross-cohort distribution of net wealth have become deeper on the negative side and higher on the positive side. The shift on the negative side is larger than on the positive side, however.

6 Measures of risk

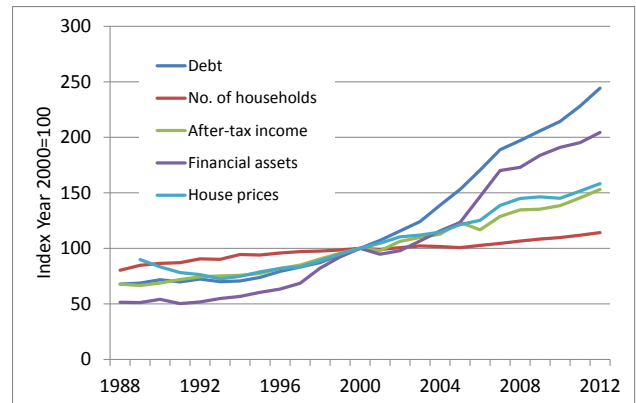
How does the distribution of debt across households affect the risk of default? How does it affect households sensitivity to shocks, such as higher interest rates or falling house prices? To answer these questions, it is useful to consider indicators that reflect different risk factors.

Before presenting different risk indicators, we show the development in important variables at the aggregate level. Figure 7 shows that, particularly in the 2000s, household debt has grown faster than both financial assets, income and house prices. The number of households has also increased, but not in a magnitude comparable to the other variables.

⁶We should remind the reader that the value of other financial assets is volatile. Due to data limitations, we do not include housing wealth.

⁷The implementation of the reform started in 2011, but important elements were clear at an earlier stage.

Figure 7: Aggregated household data and house prices. 2000-prices. 1987-2012¹⁾



1) House prices from 1989.

Sources: Statistics Norway and Norges Bank

6.1 Debt-to-income and interest payment-to-income ratios. Which debt and which income?

Debt-to-income ratio is a frequently used indicator of credit risk in the household sector. Depending on what one wants to highlight, different measures can be used.

One measure is the *debt-to-after tax income*. After-tax income is the income available for consumption, saving and debt service. This ratio is a rough measure of the share of household income needed to service the debt per percentage point loan-interest rate. Due to high debt growth, this share increased from 1.3 in 2000 to 2.1 in 2012. Hence, in the 2000s, Norwegian households have become more vulnerable to interest rate increases.

A frequently used measure of the debt ratio is the *debt-to-disposable income* ratio. Disposable income is after-tax income less interest expenses and is the income available for consumption and saving.

A third alternative is the *debt-to-debt servicing income* ratio. Debt servicing income is after-tax income less standard cost of consumption. This income measure can be interpreted as the maximum income available to the household to service debt.

Figure 8a shows the development in disposable income and debt servicing income. The development in income 2005 and 2006 reflects changes in the Norwegian tax system. In the 2000s, debt servicing income has grown faster than disposable income. This is because prices of important items in the standard budget basket have fallen due to an

increasing share of cheap imports from emerging economies such as China. This has left more of households' income available for debt service.

Rather than using total debt, one may use net debt defined as debt minus bank deposits as the numerator in measures of the debt ratio. Figure 8a also shows growth in debt and net debt. A motivation for using net debt is that a household may easily use deposits to increase the down payment of its debt. Debt has grown faster than deposits and the slope of net debt is therefore less steep than that of debt.

Combining the disposable income and debt servicing income measures with debt and net debt, we obtain four different debt-to-income measures, see Figure 8b. The measures based on disposable income increases rather rapidly in the aftermath of the Norwegian banking crisis, i.e. from the mid-nineties. The measures based on debt servicing income show a more modest development. The increase in the 2000s has basically canceled out a decline in the nineties. All indicators increased in the 2000s and leveled off after the financial crisis.

Figure 8c shows the evolution in debt-to-disposable income across cohorts. We see that there is a general and significant shift upwards in this measure of the debt ratio after 2000. The younger households reach a debt-to-disposable income ratio of 300 per cent at the end of our sample. If we instead look at net debt-to-debt servicing income, the development is rather different, see Figure 8d. This debt-ratio measure declines over time in all elderly, and also many of the middle-age, households. Even among younger households this measure shows a more modest development. While the debt-to-disposable income measure indicates that younger generations have increased their debt ratio compared with earlier generations, this is less clear when we look at the alternative net debt-to-debt servicing income ratio.

In Norway, a rule of thumb is that a household should not borrow more than three times its gross income. This corresponds to debt not exceeding five times disposable income. As can be seen from Figure 8e, in 2012, 12 per cent of the households had a debt-to-disposable income ratio of more than 500 per cent. These households held 35 per cent of total household debt. Comparing 2012 with the situation in the mid-nineties, we find that the share of highly indebted households has more than doubled and that their share of debt has tripled. Figure 9a shows that much of this debt can be found among younger households with a modest income. The exposure is small for the very youngest house-

holds and households in income deciles 1-3.

6.2 Financial margin

In this section we look at how much the household has left of their income for consumption and saving after interest expenses. A much used indicator is the interest burden, i.e. the interest payment-to-income after tax ratio. Figure 9b shows the share of households that use more than 20 per cent of their after-tax income on interest payment and their share of household debt. The share of households with a high interest burden is not large, but it is sensitive to changes in the interest rate. In 2008, the interest rate increased rather modestly and stayed well below the 2002 level. Still, the share of households with a high interest burden climbed to a rather high level and above that observed in 2002. As a consequence, households' maximum income available for consumption and saving declined.

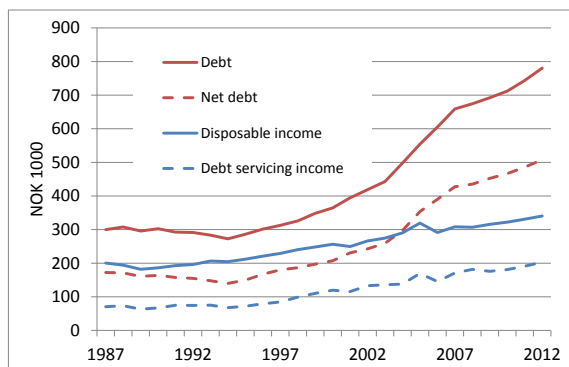
A better measure of how much the households has left for consumption and saving is households' financial margin defined as after-tax income less interest expenses, less standard cost of consumption, see Figure 9c. A positive margin can be used to save more or to consume above the standard consumption level.

Standard cost of consumption has fallen relative to income over time. In the early 1990s, households on average used 70 per cent of their after-tax income on this consumption, while in 2012 they used 45 per cent. In addition to the fall in the share of standard consumption, banks' interest rate on loans to households has fallen. As a result, the interest payment-to-income after tax ratio has declined over time despite the increase in the debt ratio. On average, the households used about 17 per cent of their after-tax income on interest payments in the early 1990s and 8.5 per cent in 2012.

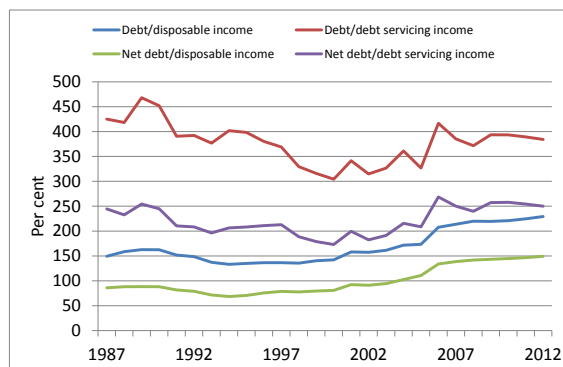
We measure the financial margin in number of monthly after-tax income. If the calculated margin is negative, the household's debt servicing income is not sufficient to pay interest on its debt. This approach implicitly assumes that ordinary living expenses have priority over interest payments and instalments on debt. Due to the favourable development in consumer prices and interest rates, the fraction of households with no or small positive margin has fallen, see Figure 9d. These households' share of total debt has also fallen, see Figure 9e. In the early 1990s, nearly 30 per cent of the households had a margin less than one monthly after-tax income. These households held about 40

Figure 8: Measures of risk. Panel I

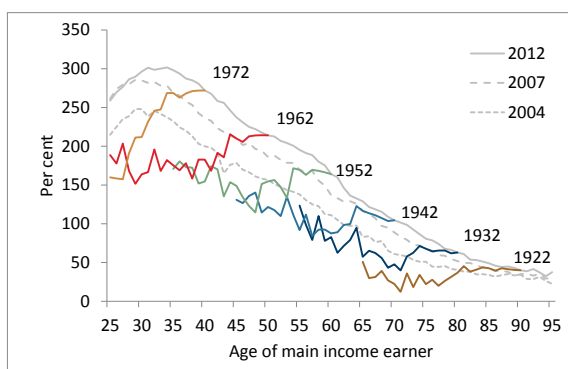
(a) Alternative debt and income definitions. Mean. 2000-prices. 1987-2012



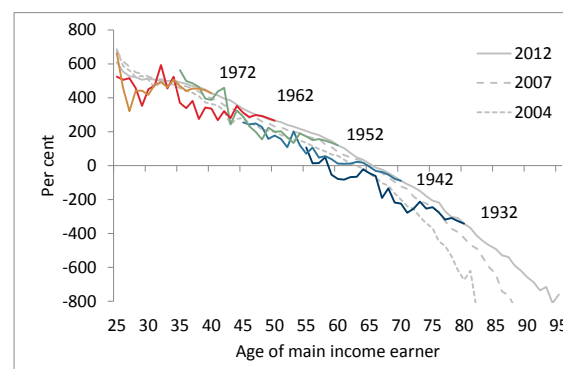
(b) Alternative debt-to-income ratios. 1987-2012



(c) Debt-to-disposable income ratio. Cohort analysis, 1987-2012. By age and birth year of main income earner. Mean. 2000-prices



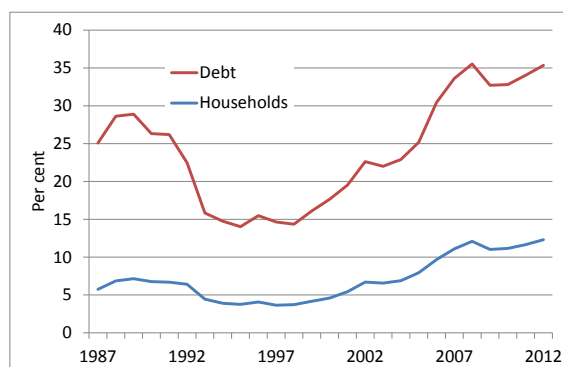
(d) Net debt-to-debt servicing income ratio. Cohort analysis, 1987-2012. By age and birth year of main income earner. Mean. 2000-prices¹⁾



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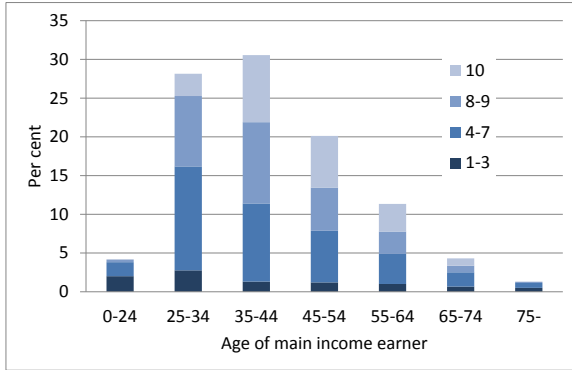
(e) Households with debt exceeding five times disposable income. Share of households and debt. 1987-2012



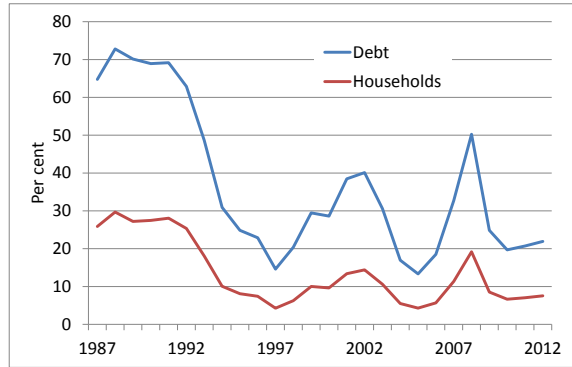
1) Due to few observations, the series for the 1922-cohort is very volatile and excluded.
Sources: Statistics Norway, SIFO and Norges Bank

Figure 9: Measures of risk. Panel II

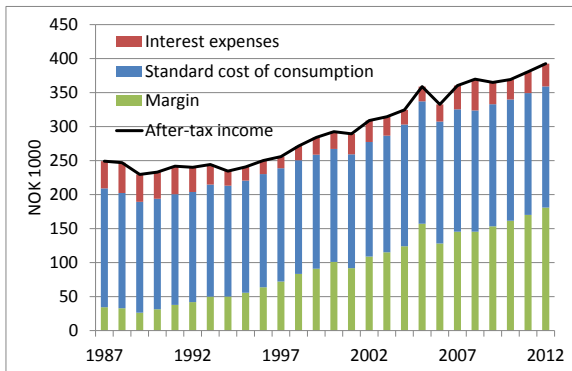
(a) Distribution of debt of households with a debt-to-disposable income ratio of more than 500 per cent by age and income-decile group. 2012



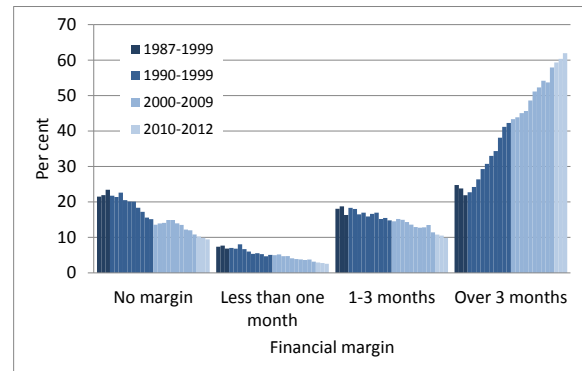
(b) Households using more than 20 per cent of after-tax income on interest expenses. Share of households and debt. 1987-2012



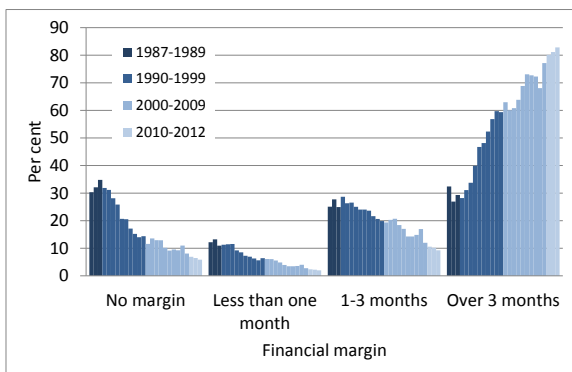
(c) Financial margin. Mean. 2000-prices. 1987-2012



(d) Distribution of households by size of financial margin measured in number of monthly after-tax income. 1987-2012



(e) Distribution of debt by financial margin measured in number of monthly after-tax income. 1987-2012



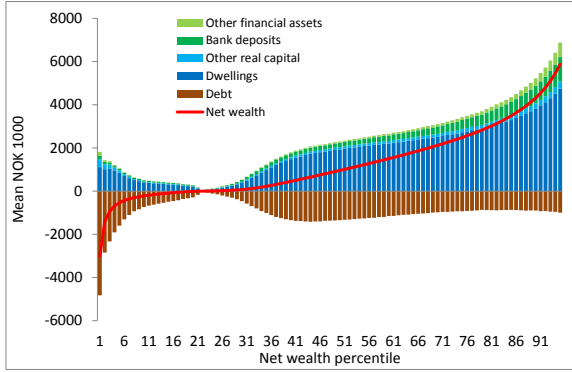
(f) Distribution of debt of households with a margin less than one monthly after-tax income by age and after-tax income-decile group. 2012



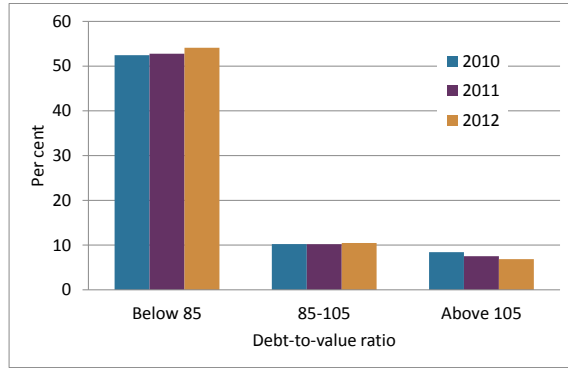
Sources: Statistics Norway and Norges Bank

Figure 10: Measures of risk. Panel III

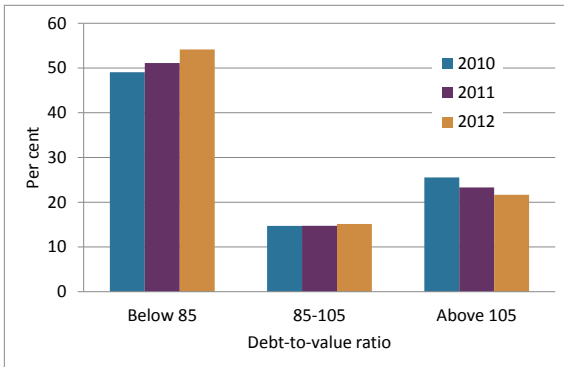
(a) Distribution of assets, debt and net wealth by net wealth percentile. Percentile 1-95¹⁾. Mean. 2000-prices. 2012



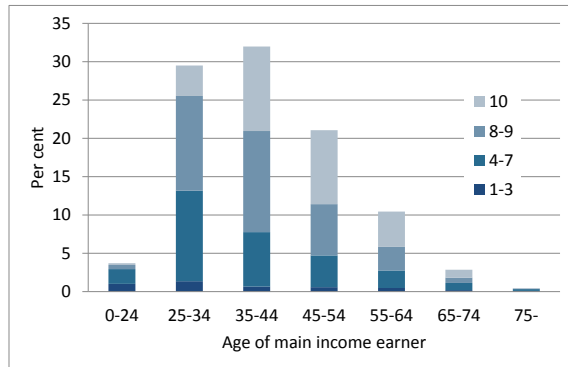
(b) Distribution of households by debt-to-value ratio in per cent²⁾. 2010-2012



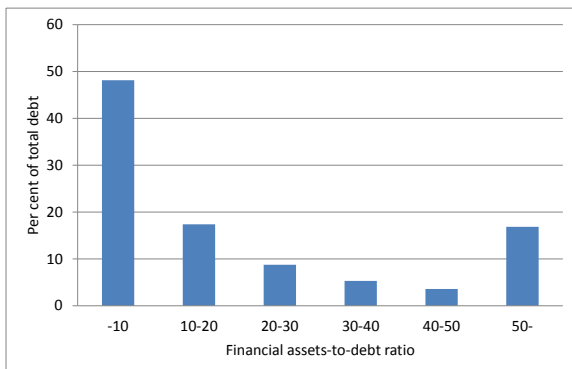
(c) Distribution of debt by debt-to-value ratio in per cent²⁾. 2010-2012



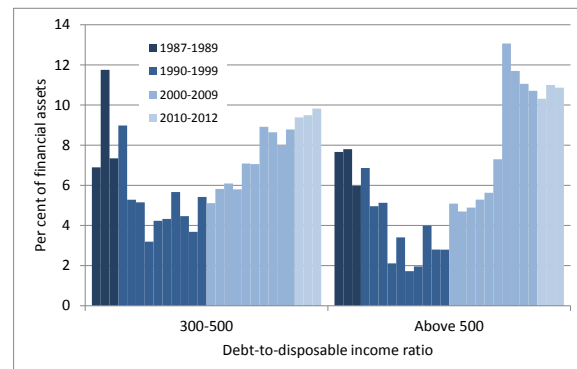
(d) Distribution of debt of households with debt exceeding 85 per cent of the value of dwellings by age and income-decile group. 2012



(e) Distribution of debt by financial assets-to-debt ratio in per cent. 2012



(f) Distribution of financial assets by debt-to-disposable income ratios in per cent. 1987-2012



1) Truncated for graphical reasons. Mean net wealth for percentile 100 is NOK 33 millions.

2) Debt-to-estimated value of the dwelling ratio.

Sources: Statistics Norway and Norges Bank

per cent of total household debt. In 2012, the corresponding numbers were 12 per cent of households and 8 per cent of total household debt. Figure 9f shows the distribution of households with a margin of less than one monthly income by age and income decile. The debt held by these low-margin households is more concentrated among young and low income households than debt held by households with a debt-to-income ratio above 500 per cent.

6.3 Debt-to-value ratio

Although the aggregate household equity ratio is high, 20 per cent of the households have negative net wealth. This can be seen in Figure 10a where households are ordered by increasing net wealth and divided into 100 equal-sized groups. The households with negative net wealth typically have debt that exceeds the estimated market value of their house. This may be due to an underestimation of the market value of some dwellings. A limited number of attributes go into the estimation of the market value. A nice view or a shoreline will not be included, but will affect the value of the house. It is also possible that households use other sources of collateral. This cannot be observed from the tax return data.

Since we can not identify mortgages as a separate class in our data, we look at the relationship between total debt and housing value, i.e. a debt-to-value ratio (DTV). We calculate this based on the estimated value of dwellings. From the bank statistics we know that mortgages dominate loans to households, i.e. 86 per cent in 2012. Mortgage loans typically have a lower interest rate than consumer loans and are therefore more attractive for the households. In our calculations, we assume that if a household owns a dwelling, its debt is collateralised mortgage debt.

In a circular in 2012, the Financial Supervisory Authority of Norway (Finanstilsynet) recommended that banks' mortgage loans should not exceed 85 per cent of the value of dwellings, see Financial Supervisory Authority of Norway (2011). In 2012, more than 15 per cent of the households owned a dwelling with a DTV above this level, see Figure 10b. These households held more than 35 per cent of total household debt, see Figure 10c. The share of households with a DTV above 85 per cent and the share of these households' debt of total debt have fallen slightly since 2010. The distribution of debt with DTV above 85 per cent shows that the larger part of this debt is held by households in the higher income groups, see Figure 10d.

Very little is found in households within the lowest income deciles or among the youngest households.

6.4 Debt-to-financial assets

In the previous section we have analysed the extent to which debt is backed by income or dwellings. In this section we look at how debt is backed by financial assets. Financial assets have grown faster than after-tax income, see Figure 7.

Figure 10e shows that nearly half the debt is held by households whose financial assets are less than ten per cent of debt. Approximately one-fourth of the debt is held by households with a debt-to-financial assets ratio of 30 per cent or more.

In Figure 10f we look at households with moderate and high debt-to-disposable income ratios. In 2012, households with debt-to-disposable income exceeding 500 per cent held 35 per cent of the debt but only 11 per cent of total financial assets. We conclude that financial assets serve as collateral only to a limited degree for high debt. This is consistent with Figure 10a, which shows that financial assets and debt are unequally distributed across households.

We order the households by increasing net wealth and divide them into four equal-sized groups. The quartile with highest net wealth is further divided into the one per cent richest households, the next four per cent richest, and the rest of the quartile, see Figure 11. Financial assets have a skewed distribution, and the richest households hold 65 per cent of bank deposits and 90 per cent of other financial assets.

After deposits, unregistered securities are the most important financial assets. The one per cent richest households own 60 per cent of other financial assets, see Figure 11b. Hence, assets are far more unevenly distributed than debt.

6.5 Combination of risk measures

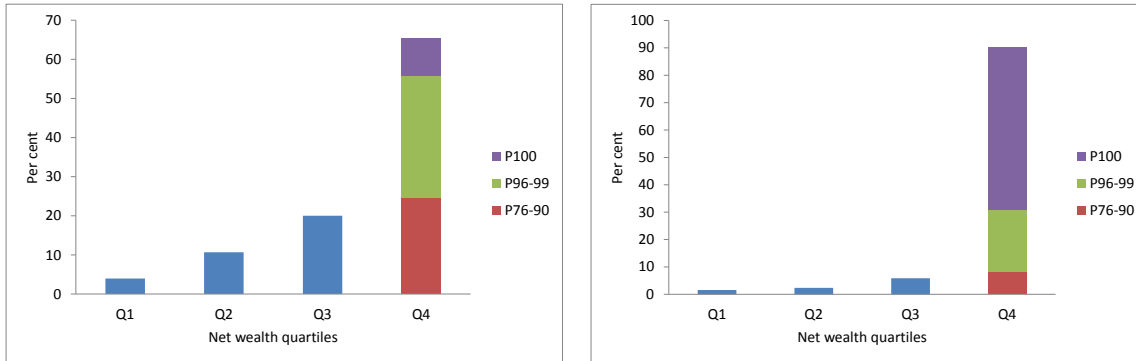
We will now look at a framework to identify risky households, i.e. the households that are likely to default and therefore represent a credit risk, see Solheim and Vatne (2013) for the first presentation of this framework.

There are reasons to believe that both households and banks prefer to avoid default if possible. Default may force a household to sell the dwelling and also severely constrains the household's financial freedom of manoeuvre. In addition, a forced sale may imply losses to the bank. For a household to default, we therefore expect the household to

Figure 11: Distribution of financial assets by net wealth quartile

(a) Bank deposits

(b) Other financial assets



1) The households are ordered by increasing net wealth and divided into four equal sized groups. The fourth group is divided into percentiles.

be risky along several dimensions simultaneously, making it more difficult to renegotiate the loan contract and avoid default.

We expect a household with good debt-servicing capacity, but poor collateral, to be able to reduce its loan-to-asset ratio by making additional principal repayments. If its debt-servicing capacity is poor, but its collateral is good, an interest-free period or payment deferral can often be negotiated with the bank. If the household's debt is low, it should be easier to obtain a favourable repayment arrangement than if debt is high.

We will now define and combine three risk criteria based on risk measures presented in earlier chapters. These risk criteria reflect the notion introduced above.

- DTI Debt above five times disposable income.
- MRG Margin below one monthly after-tax income. Margin is income less taxes, interest expenses and standard cost of consumption.
- NDV Net debt, i.e. debt less deposits, larger than the value of the dwelling.

In Table 4 and Figure 12a we show the three risk criteria one by one and combined in 2012. We concentrate on the share of risky debt, i.e. the debt held by households classified as risky according to the different risk criteria.

Households' debt-servicing capacity is covered by criteria DTI and MRG. In 2012, criterion DTI,

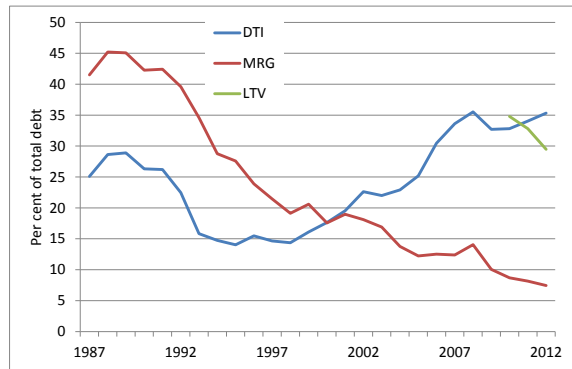
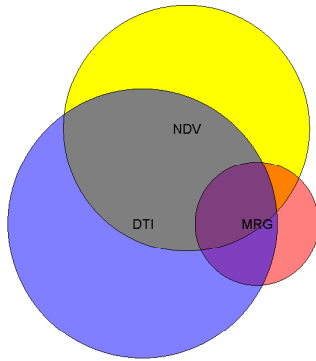
Table 4: Share of households and debt of households that violate the different risk criteria. Per cent. 2012

Criteria	Households	Debt
DTI	12	35
MRG	16	8
NDV	24	30
DTI + MRG	3	5
DTI + NDV	5	16
MRG + NDV	7	4
DTI + MRG + NDV	1	2

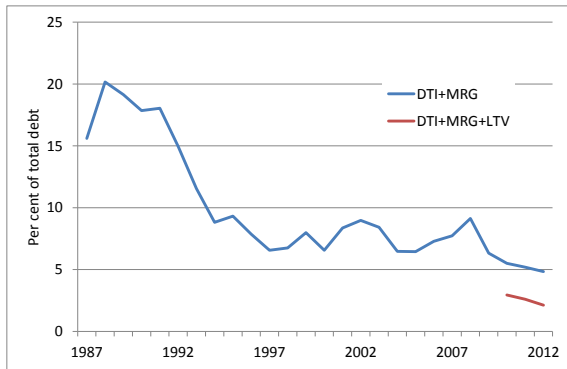
debt below five times disposable income, is stricter than criterion MRG, a margin below one monthly after-tax income, see Table 4. More than one-third of total debt was held by households whose debt exceeds five times disposable income (DTI). Households with surplus liquidity below one monthly after-tax income (MRG) held 8 per cent of total debt, while 5 per cent of debt was held by households that violate both criteria (DTI+MRG). This reflects that many high-debt households also are high-income households and therefore have considerable debt-servicing capacity. The table also shows that 30 per cent of debt was held by households whose net debt exceeds the market value of the dwelling (NDV). This debt is defined as poorly collateralised. Of the households with poorly collateralised debt, approximately 50 per cent also has high debt relative to income and violate DTI and NDV simultaneously. Households with low margin

Figure 12: Combination of credit risk measures

- (a) Share of debt held by risky households when combining the three risk criteria. 2012
- (b) Single criteria. 1987-2012



- (c) Combined criterion. 1987-2012



- (d) Distribution of debt of households that violate the combined credit risk criterion (DTI+MRG+NDV) by age and after-tax income decile group. 2012



Sources: Statistics Norway, SIFO and Norges Bank

(MRG) and low collateral (NDV) are expected to have less leeway to negotiate their loan contract with the bank and are thus more likely to default. In particular we expect households that violate the combined criterion (DTI+MRG+NDV) to have a high probability of default.

Figure 12b shows the development over time in the share of risky debt defined by the three risk criteria separately, in Figure 12c the criteria is combined. For reasons explained previously, we have NDV for 2010-2012 only. As from the mid-1990s, DTI has increased, while MRG has decreased. The combined criterion shows that credit risk has declined over time.

The distribution of debt in household that violate (DTI+MRG+NDV) by age and income groups is shown in Figure 12d. Observe that even though a large part of risky debt is found among young households in low income groups, a substantially

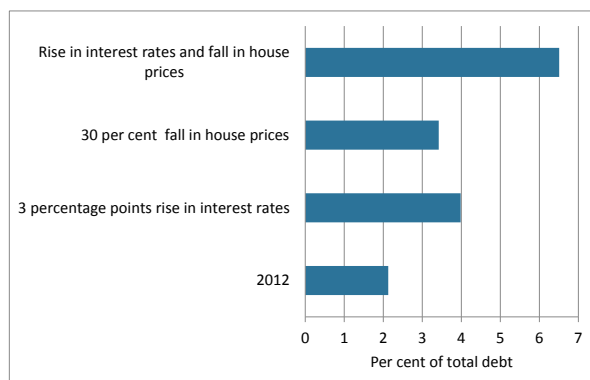
part of the risky debt is found in low-to-middle income groups in middle-aged households.

6.6 Sensitivity analysis

The risk indicators discussed in the previous chapter are sensitive to an increase in the interest rate or a fall in house prices. We calculate the static, impact effect on the risk indicators keeping all other variables unchanged, see Figure 13. A higher interest rate reduces disposable income and hence increases the debt-to-disposable income ratio. It also decreases the margin measured by the MRG due to increasing interest payments. A fall in house prices increases the NDV ratio.

In 2012, banks' average interest rate on loans to households was 4 1/2 per cent, and 3 per cent of the households violated the combined debt-to-income and margin criteria (DTI+MRG). If the interest rate rises with 3 percentage points,

Figure 13: Share of debt held by households that violate the combined credit risk criterion (DTI+MRG+NDV) in 2012 and if interest rates increase and house prices fall. 2012



Sources: Statistics Norway and Norges Bank

the share of debt that violates all three criteria (DTI+MRG+NDV) rises from 2 to 4 per cent, see Figure 13.

Initially, 24 per cent of the households and 30 per cent of debt violate the NDV criterion. If house prices fall with 30 per cent, the share of total debt held by households that violates the combined criterion (DTI+MRG+NDV) rises to almost 3.5 per cent, see Figure 13.

The most serious situation occur if we have a combination of higher interest rates and a fall in house prices. In this case, the share of debt held by households violating the combined criterion increases from 2 to 6.5 per cent, see Figure 13.

7 Conclusions

The household sector in Norway is highly indebted. In this paper we use household-level panel-data to evaluate the distribution of debt across households, their debt servicing capacity and shock resistance. This enables us to identify pockets of credit risk.

- We find that a very large share of household debt, 95 per cent in 2012, is held by half of households. Debt is unevenly distributed across income and total assets, and households with high income and wealth also have high debt.
- Looking across households' age, we find that the distribution of debt is in line with the the fact that most households own their own

dwelling. Households borrow largely in their thirties and forties to buy a dwelling.

- From 2000 to 2012 household debt grew by 144 per cent. The most important contribution comes from an increase in debt per household. Over this period, mean debt almost doubled among households with debt.
- A very large share of households adjust their level of debt up and down within a year. During 2012, about one-third of households increased or decreased their debt by more than NOK 100 000. More than 40 per cent of the increase in household debt can be related to home-equity withdrawal, while less than 15 per cent is related to first-time home-buying.
- About two-third of households own the dwelling in which they live. Housing wealth accounts for about 60 per cent of total household wealth. However, this figure does not include insurance or pension claims. Household net wealth, i.e. equity-to-total assets ratio was 64 per cent in 2012.
- The 25 per cent richest, measured by total net wealth, owns 65 per cent of all deposits and 90 per cent of other financial assets. They hold approximately 25 per cent of total household debt. The one per cent richest owns 60 per cent of other financial assets, which primarily comprise securities.
- The debt-to-disposable income ratio increased across all cohorts in the 2000s, also the very old. When we factor in the change in the cost of living, the net debt-to-debt servicing income ratio continued to follow the expected concave life-cycle pattern also in this period.
- We find that in 2012 only 2 per cent of household debt was held by households classified as risky according to our strict definition. These households are less likely to be able to renegotiate their debt terms, or increase their debt, if an unfavourable event occurs.

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A Descriptive tables

Mean after-tax income by age and income group. NOK 1000

	Age of main income earner							After-tax income decile										All
	0-24	25-34	35-44	45-54	55-64	65-74	75-	1	2	3	4	5	6	7	8	9	10	
1987	130	183	223	234	177	114	77	41	68	94	117	143	172	199	228	267	374	170
1988	137	196	233	242	188	121	84	49	75	101	122	149	181	211	242	283	387	180
1989	113	196	224	236	194	125	87	23	70	94	114	140	171	203	240	280	416	175
1990	117	196	241	253	201	134	95	45	74	99	122	147	180	216	254	297	414	185
1991	124	202	249	270	211	144	106	49	81	108	132	157	191	228	270	317	452	198
1992	119	214	251	275	220	149	105	47	81	106	131	157	192	235	278	329	462	202
1993	127	215	264	284	229	155	105	49	82	110	136	164	201	243	285	335	493	210
1994	112	209	264	279	223	163	104	44	77	103	130	158	192	235	282	333	491	204
1995	113	214	278	294	242	170	112	49	84	112	141	168	202	248	295	347	503	215
1996	119	223	292	305	259	168	119	51	89	118	146	172	207	252	304	362	558	226
1997	119	237	307	326	264	182	123	53	92	123	152	182	219	269	321	379	583	237
1998	131	261	328	342	288	189	140	56	103	136	166	198	240	293	348	410	622	257
1999	142	275	347	362	313	210	151	67	110	145	179	213	257	311	369	435	668	275
2000	151	293	371	394	334	219	151	68	113	148	185	220	266	322	382	452	771	293
2001	148	313	369	397	337	219	161	63	121	157	196	235	283	344	405	477	701	298
2002	154	312	392	447	371	240	177	65	124	163	204	245	295	357	422	499	849	322
2003	150	313	413	443	404	278	189	68	129	167	208	251	303	368	438	519	912	336
2004	160	338	437	449	407	282	194	70	134	175	220	264	317	380	449	530	947	349
2005	166	356	477	534	460	325	215	67	139	183	231	278	337	409	483	573	1 215	391
2006	159	352	461	482	425	305	217	66	145	191	241	291	353	427	504	596	896	371
2007	175	376	499	528	467	343	239	74	157	206	260	313	380	461	545	647	1 009	405
2008	185	400	533	562	492	370	257	57	168	221	279	337	408	495	585	696	1 068	432
2009	182	401	537	563	501	377	260	66	173	225	283	342	413	500	592	704	1 052	435
2010	183	409	553	586	520	402	275	69	178	231	291	353	426	516	611	727	1 105	451
2011	187	419	575	607	552	435	294	72	186	239	302	368	446	538	637	760	1 156	470
2012	191	431	594	631	581	460	309	76	192	248	312	381	461	558	663	793	1 205	489

Mean total debt by age and income group. NOK 1000

	Age of main income earner							After-tax income decile										All
	0-24	25-34	35-44	45-54	55-64	65-74	75-	1	2	3	4	5	6	7	8	9	10	
1987	167	364	363	264	140	38	7	39	24	43	90	155	202	269	311	417	612	216
1988	185	382	390	314	161	42	12	15	32	71	112	154	225	272	331	437	719	237
1989	127	386	443	294	181	42	9	43	31	49	87	135	211	277	338	441	766	238
1990	144	369	449	358	183	56	18	52	36	64	102	160	220	289	379	441	790	253
1991	114	371	434	344	174	43	13	34	33	58	126	180	230	320	348	465	738	253
1992	145	385	426	354	182	60	23	46	50	81	113	213	257	295	382	471	674	258
1993	129	348	439	372	185	57	18	63	40	76	118	212	229	322	368	468	674	257
1994	112	344	425	357	188	76	30	66	45	74	109	175	234	302	391	454	654	250
1995	113	364	454	374	235	76	31	70	68	89	119	205	282	304	409	504	646	270
1996	137	381	481	406	226	76	32	74	57	108	155	203	263	333	424	539	718	287
1997	141	415	523	421	223	93	31	74	72	106	154	230	276	366	459	567	753	306
1998	155	451	535	438	244	104	36	88	75	126	166	226	295	391	497	599	795	326
1999	165	494	592	482	242	106	46	81	89	150	175	260	333	442	532	620	881	356
2000	197	539	622	521	290	109	47	70	90	153	199	266	344	464	566	720	975	385
2001	184	643	679	561	336	113	57	115	85	155	225	298	408	514	615	804	1 069	429
2002	187	683	728	616	358	120	53	144	92	168	244	335	411	565	683	840	1 131	461
2003	203	706	786	664	410	163	59	163	100	194	262	363	456	604	724	921	1 211	500
2004	234	780	895	754	490	185	69	163	132	216	308	392	550	653	829	1 027	1 374	564
2005	277	879	988	834	552	241	92	183	135	238	350	461	588	759	952	1 126	1 584	638
2006	318	968	1 092	928	628	291	110	212	151	264	386	519	658	838	1 050	1 254	1 791	712
2007	347	1 051	1 201	1 017	690	326	123	220	158	289	423	572	712	912	1 158	1 386	1 984	782
2008	353	1 098	1 287	1 083	736	356	133	267	159	291	440	598	751	958	1 240	1 491	2 108	830
2009	343	1 122	1 358	1 147	787	393	142	263	169	314	478	613	775	1 007	1 299	1 581	2 204	870
2010	347	1 157	1 442	1 220	844	429	152	254	174	323	511	641	810	1 068	1 378	1 676	2 334	917
2011	365	1 203	1 532	1 294	912	469	167	264	182	333	544	697	832	1 115	1 458	1 782	2 490	970
2012	381	1 251	1 623	1 374	979	512	186	262	191	345	570	736	881	1 175	1 543	1 894	2 659	1 026

B A chronological review of analyses at Norges Bank based on household micro data

For the last 10 years, Norges Bank has received anonymized household-level panel data from Statistics Norway for research purpose. The primary data source is annual tax returns. The first results from applying these micro data were presented in Financial stability 2/2005 pp. 24-25. This analysis focuses on the relationship between debt and disposable income and also debt and financial assets. It concludes that a considerable share of the debt in 2003 was held by households with a high debt burden. At the same time, only a small portion of financial assets was held by these households. Therefore, growth in financial assets had only to a limited degree reduced the risk associated with the high rate of debt accumulation as from the mid nineties.

A more extensive analysis of the micro data was given in Magdalena D. Riiser and Bjørn H. Vatne. *Developments in household debt. An analysis of micro data for the period 1986-2003*. This analysis evaluates household debt across age and income groups to identify pockets of credit risk based on debt-to-disposable income and debt-to-financial assets measures. A decomposition of debt growth shows that particularly an increase in average debt (debt per household), but also an increase in number of households and the share of indebted households have contributed to the increase in debt since 1986. Most households had a moderate or low debt-to-income ratio. The share of debt held by households with a high debt-to-income ratio (above 500 per cent) declined in the years after the Norwegian banking crisis in 1988-1992, but this development was reversed after 1998. This primarily reflects strong debt growth among young households, i.e. the primary first-time home buyers. The analysis also shows that financial assets primarily have increased in households without debt or with a low debt-to-income ratio. Therefore, the accumulation of financial wealth can only to a limited extent act as a buffer against increases in interest expenses or fall in income.

Inspired by work at Sveriges Riksbank, financial margins defined as total income less taxes, interest payments and standard living expenses was calculated at the household level. See Bjørn H. Vatne. *How large are the financial margins of Norwegian households? An analysis of micro data for the pe-*

riod 1987/2004. Economic Bulletin 4/2006. This margin is an indicator of the household's resilience to unfavourable changes in economic conditions such as an increase in interest rates (for net debt holders) or a reduction in income. Hence, this margin provides information about the risk of losses on bank loans to the households. At the overall level, the analysis found that household margins increased substantially from the end of the 1980s to 2004. This was due to strong income growth coupled with a reduction in the share of income used to cover ordinary living expenses and borrowing costs. Most households had solid margins, although some households had small or negative margins. The share of households with negative margins had decreased over the period analyzed.

The household dataset over the years 1987-2003 is an unbalanced panel with a subset of Norwegian households. This panel does not enable us to follow households over time. From 2004 on, the dataset includes all households registered in Norway, and we can follow each household over time. This is done in Bjørn H. Vatne. *Who is borrowing for what and can they afford it? A study of comprehensive micro data for Norwegian households trough 2006*, Economic Bulletin, 2/2008. We identify which households that are net borrowers and which households that down pay their debt. We identify households that have been buying a new dwelling by taking advantage of changes in housing wealth in the tax returns. We find that loans are mainly given to households with sufficient debt-servicing ability. Many households take on as much debt as they can bear. The total debt to disposable income ratio has increased. An increasing percentage of debt is found among households with a high debt to income ratio. If we adjust income for standard living expenses, the analysis shows essentially unchanged credit risk. The data indicate that young first time home buyers do not have a larger probability of default than other groups.

Magdalena D. Riiser. *Household net lending - what the micro data indicate* Economic Bulletin 2/2009 During the banking crisis of 1988-1993, the household saving rate increased sharply from negative to positive levels, leading to reduced demand and higher loan losses in the enterprise sector. The change in net lending was the main reason for the change in the saving rate. This article uses micro data over 1987-2007 to study which groups of households can affect overall household net lending, especially when economic conditions change. The analysis shows that households in the 35-44 age group were behind the sharp rise in net

lending during the banking crisis in the late 1980s. However, the fall in net lending since 1993 has not been limited to a particular group: net lending has decreased in most age groups. The analysis indicates that the 10 percent of households with highest financial wealth (decile 10 after financial wealth) may have a particular impact on overall household net lending. Decile 10 accounts for a large and rising proportion of growth in financial wealth, but a low proportion of growth in debt. This means that decile 10 is pushing up overall household net lending. Whether overall net lending is positive or negative will depend on how far debt grows in deciles 1-9.

In 2010, the Financial Supervisory Authority of Norway issued new guidelines for prudent residential mortgage-lending practice. These guidelines include recommended loan-to-income and loan-to-collateral value ratios. The article, Bjørn Helge Vatne, *Hva er virkningen av reguleringer av boliglån? Penger og Kreditt 1/10*. (In Norwegian), sheds light on the effect of the new guidelines on debt growth. We apply household-level panel data for 2006-2007. Using a set of simplifying assumptions, we find that if the new guidelines had been followed effectively by banks in 2007, the annual debt growth this year would have been reduced from 12 per cent to between 4 and 8 per cent.

Residential mortgage loans account for more than half of banks total lending. It is therefore important to understand the risks related to housing debt when analysing financial stability. Two factors are of particular interest: household debt-servicing capacity and the ratio of mortgage debt to the value of the dwelling. According to the tax return data, 80 per cent of total household debt was held by homeowners in 2007. Bjørn Helge Vatne. *Housing and debt*. Economic commentaries 9/2009. One third of the growth in household debt was related to home purchases. In one in nineteen households, debt was higher than the value of the dwelling and more than 20 per cent of the household income was used for interest payments. These households accounted for close to one fifth of total household debt. Stress tests show that households with large mortgages are vulnerable to higher interest rates and a fall in house prices.

In Dag Henning Jacobsen and Bjørn Helge Vatne. The impact of house prices on household debt when controlling for home ownership. Working Paper 2011/08, we analyze the effect of house price changes on debt secured on dwellings in Norway. For this purpose, we use both macro time

series and micro panel data. With the intention of being both a cross-check and motivation for the micro analysis, we estimate a structural vector-auto regression model using macro variables. A key result of the macro analysis is that positive house price innovations have positive and persistent effects on households debt secured on dwellings. Results from the micro data analysis suggest that the effect of house price changes on the borrowing decision differs from the effect on the installment decision among existing home owners. These results are further investigated through a two stage model where we control for income, collateral value and age. The model predicts that the size of both loans and installments increase with income. Loan size increases and the installments fall with increasing collateral value. These results support the existence of a wealth channel of housing but do not provide support for a collateral channel.

Over the past twenty years, the distribution of debt and wealth has changed across age groups. This is analyzed in Haakon Solheim and Bjørn Helge Vatne. *Distribution of household debt burden across age groups*. Economic Commentaries 2/2011. Households are divided into cohorts based on the age of the main income earner. Older households have more debt than previously and are holding a greater share of total wealth. Even though the level of debt has not risen as much among younger households in relative terms, the risk associated with the loans of younger households is higher, since debt has grown faster than their housing wealth.

From a broad financial stability perspective, sustainable household debt should be evaluated within a steady-state consumption-path approach. This is the starting point of Kjersti-Gro Lindquist. *Sustainable household debt: Towards an operational view and framework*, Staff Memo 33/2012. We calculate measures for households' steady-state consumption based on average consumption to income ratios for a number of household groups. This consumption-expenditure ratio is clearly convex across age groups, consistent with the life-cycle theory. We use a 'counterfactual history approach' to evaluate households' debt sustainability. The results show that households within the first-time home buyer and second stepper groups, which hold more than half of total household debt in Norway, are vulnerable to an increase in the loan rate. These groups count for about 1/3 of total household consumption and are therefore important also from a consumption-fall risk perspective.

The default rate on loans to households by Nor-

wegian banks and mortgage companies fell after the banking crisis in the 1990s and has been low since the turn of the millennium. In Haakon Solheim and Bjørn H. Vatne. *Measures of household credit risk*. Economic commentaries 8/2013 we argue that credit risk arises in households that have high debt, low debt-servicing capacity and inadequate collateral at the same time. Even though debt burdens have risen to historically high levels, the share of debt held by households with poor debt-servicing capacity and low collateral has fallen since the beginning of the 1990s. However, the size of the vulnerable group is sensitive to shocks, such as higher interest rates, lower purchasing power or a decline in house prices.

Haakon Solheim and Bjørn H. Vatne. *Evidence of a change in banks' lending practices after the financial crisis*. Economic commentaries 3/2014 analyse the behaviour of Norwegian households using tax return data that covers debt, income, financial assets and housing wealth. In the period from 2004 to 2008 borrowing in Norwegian households increased significantly. Behaviour changes after 2008. The Financial Supervisory Authority of Norway has recommended that banks impose stricter LTV (loan-to-value) requirements. They find that debt-to-housing value (DTV) has fallen from 2008 to 2012, especially among younger households. High income groups have been able to maintain a high level of debt to income, but have increased their holdings of liquid financial assets. Lower income groups take on less debt relative to income and have not been able to increase holdings of financial assets.