

ECONOMIC COMMENTARIES

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DECOMPOSITION OF THE
INCREASE IN HOUSEHOLD
DEBT

By Kjersti-Gro Lindquist, Haakon Solheim and Bjørn Helge Vatne¹

Average debt among Norwegian households has increased substantially over time. A decomposition analysis shows that debt growth to a great extent reflects higher incomes and higher house values. For homeowners, debt growth has also been driven by an increased willingness or ability to borrow. For home buyers, both first-time buyers and homeowners buying a new home, reduced borrowing related to the value of the dwelling has curbed the increase in debt. This is in line with the expected effect of a new regulation setting stricter requirements for residential mortgage loans.

1. Introduction

The high level of debt among Norwegian households is considered to be the most important source of financial vulnerability in Norway.² The debt level is high, both compared with historical figures and with most other countries, and debt continues to rise faster than income.

Household borrowing is closely related to home purchases, which are largely determined by the stage of the life cycle and income. At the same time, households' willingness and ability to borrow can vary over time. We use a statistical method to decompose the increase in average household debt in Norway between 2010 and 2015 into developments in variables, such as income and house values, the distribution of the population into groups according to stage of the life cycle and rural/urban location on the one hand, and changes in the propensity to borrow on the other, ie changes in the willingness and ability to borrow given a certain level of income and housing wealth, age group and rural/urban location.

The analysis shows that for households as a whole, debt growth between 2010 and 2015 to a great extent reflects higher income and higher house values. Among first-time buyers, increased average debt can primarily be attributed to higher house prices. House prices were higher in 2015 than in 2010.

¹ The authors are all on the staff of the Financial Stability Department. The views and conclusions expressed in this publication are those of the authors and not necessarily those of Norges Bank and must not be reported as Norges Bank's views. We thank colleagues in Norges Bank, in particular Henrik Borchgrevink and Torbjørn Hægeland, for useful input and comments. Any errors or omissions are solely the responsibility of the authors.

² See Section 1 of Norges Bank (2017) and Lindquist, Solheim and Vatne (2017) for a discussion and analysis of various types of risk for the categories analysed in this paper.

At the same time, we find that other factors may have contributed to curbing debt growth. First-time buyers' borrowing related to the value of the dwelling declined in this period. The same applies to home movers, ie homeowners who trade up in the housing market. First-time buyers also reduced their borrowing related to income. These developments may have been prompted by stricter residential mortgage lending requirements, but it has not been possible to isolate the effect of regulation in this analysis.

2. Decomposition method

The analysis is based on a combination of income statistics for households compiled by Statistics Norway (based on tax assessment data from the Norwegian Tax Administration) and information on home purchases from the Norwegian Mapping Authority's national property registry.³ The following model for household debt is estimated^{4,5} for each of the two selected years, $t \in \{2010, 2015\}$:

$$(1) \quad Debt_{it} = X'_{it}\beta_t + \varepsilon_{it}, \quad E(\varepsilon_{it}) = 0$$

where i designates households; $Debt_i$ is debt at constant prices; X_i is a vector with the following explanatory variables: $Income_i$, which is income after taxes at constant prices, $House_i$, which is the market value of the dwelling at constant prices, $Urban_i$, which is a dummy variable for living in Oslo, Bergen, Trondheim or Stavanger⁶, Age_i , which is age dummy variables for each age group included in the analysis (maximum age range 20-89 years). A constant term, $Cons$, is also included. The least-squares method is used. All the coefficients in the β_t vector (including the constant term) are year-specific.

Using the estimated model on two sets of cross-sectional data, the increase in expected, ie average, debt between 2010 and 2015 is calculated:

$$(2) \quad R = \overline{Debt}_{2015} - \overline{Debt}_{2010} = \overline{X}_{2015}'\widehat{\beta}_{2015} - \overline{X}_{2010}'\widehat{\beta}_{2010}$$

The top line designates an average and the hat symbol above the coefficient vectors designates the estimated coefficients.

The method decomposes R into three exhaustive factors,

$$(3) \quad R = E + C + I$$

³ The analysis is limited to households where the main income earner is aged between 20 and 90. Self-employed persons are excluded. For a detailed discussion of the data, see Appendix 1.

⁴ Using the Blinder-Oaxaca decomposition method in Stata. See Jahn (2008).

⁵ The model is not a causal representation of household debt, but a basis for a statistical decomposition of the debt increase.

⁶ For example, household expectations of higher income or house price inflation in urban areas can lead to higher debt than for households in rural areas with the same income and house value and in the same age range.

$$= [\overline{X}_{2015} - \overline{X}_{2010}]' \widehat{\beta}_{2010} + \overline{X}_{2010}' (\widehat{\beta}_{2015} - \widehat{\beta}_{2010}) \\ + [\overline{X}_{2015} - \overline{X}_{2010}]' (\widehat{\beta}_{2015} - \widehat{\beta}_{2010}),$$

where E shows how much of the increase in average debt that can be attributed to the change in the average values of the explanatory variables (the contribution from the variables), C shows how much of the debt increase can be attributed to the difference in estimated coefficients, and I is the residual contribution, representing the remaining debt increase given the correlation between variables and coefficients, ie the covariances.

Changes in the estimated coefficients capture changes in the propensity to borrow. This comprises both household willingness to borrow and the ability to borrow from banks. It is not possible to distinguish between these two components of the propensity to borrow under this method. Finanstilsynet (Financial Supervisory Authority of Norway) introduced guidelines for banks' mortgage lending practices in March 2010, which were tightened in December 2011 and laid down in a regulation, initially with effect from July 2015. This will have an impact on the estimated coefficients in so far as it influences households' ability to borrow. Other structural changes that may influence household borrowing include the removal of the inheritance tax in 2014. Substantial financial transfers from parents or grandparents increase a household's equity and can affect the level of borrowing for, for example, first-time buyers and home movers.⁷ Changes in coefficients may also reflect other factors unobservable to the authors.

The decomposition gives a complete decomposition of changes in actual average debt. This makes it possible to assess the contribution from each of the variables income, house value, age and rural/urban location to the total contribution from these variables, E , the coefficient contribution, C , and the residual contribution, I . This also makes it possible to assess the overall total contribution, ie the sum of the factors E , C and I , from each of the explanatory variables.

3. Analysis categories

The debt relationship in (1) is estimated on data for all households and for seven sub-samples. The sub-samples largely represent different stages of the life cycle and are chosen because they reflect variations in housing market and borrowing behaviour. The categories are mutually exclusive and each household is assigned to one category. The categories are non-exhaustive and there is a residual category of "other" households.

⁷ For an analysis of the effect on borrowing and the consequences for loan-to-value and debt-to-income ratios among young first-time buyers, see Halvorsen and Lindquist (2017).

The analysis categories:

- *All*: All households, aged 20-90
- *FTB*: First-time buyers, aged 20-34
- *Home movers*: Homeowners that buy a new residential property, aged 20-90
- *SHO*: Secondary home owners with rental income, aged 20-90
- *Younger owners*: Homeowners that do not buy new homes, aged 20-44
- *Older owners*: Homeowners that do not buy new homes, aged 45-64
- *Pensioners*: Homeowners whose main source of income is their pension, aged 65-90
- *Tenants*: Households that do not own their own home, aged 20-90

First-time buyers are defined as households where the main income earner is below 35 years of age and buys his/her first home. Many people buy their first home later in life, but this is often because they have previously lived in owner-occupied housing with a partner or spouse or because they move to Norway from abroad. First-time buyers do not usually hold substantial assets and have relatively low income, but can expect faster-than-average income growth for a number of years ahead. The most important constraint on a first-time buyer entering the housing market is normally insufficient equity. Insufficient equity makes it difficult to meet banks' residential mortgage lending requirements. In a situation where the rise in house prices is outstripping income growth and the return on financial savings is low, as was the case in the analysis period, it is difficult to gain entry to the housing market by saving.

Many households buy and move to a new home once or more in the course of their lives to adjust to differing needs through the life cycle and changes in their own economic resources. As a category, these *home movers* cover a wide range of ages and behaviour. Among the younger households in this category, a home purchase is often an upgrade to meet the need for a larger dwelling, while increased equity and higher income enables them to increase their debt and buy a more expensive dwelling. After-tax income rises until the mid-40s in both analysis years. Household wealth in Norway is primarily in the form of housing equity, and home-owning households generally have more equity than non-owners. In periods of high house price inflation, homeowners will benefit from an increase in housing equity since they bought their first home, and if they in addition have paid off their mortgage, their equity will be further strengthened. Among the older people in this category, the home purchase may be motivated by a desire for a smaller or simpler home. The home purchase can largely be financed by selling the existing dwelling and by investing accumulated financial savings in the new dwelling. Consequently, the increase in debt among older home movers will be smaller, even though the value of the new dwelling is not necessarily lower than the value of the former dwelling. If an attractive, modern apartment is purchased, the opposite may be the case.

In tax statistics, secondary homes also comprise commuter accommodation and dwellings used as holiday homes. To exclude such entities, this category is delimited to *secondary homes* with rental income.

Homeowners, in both the older and younger category, borrow to finance for example purchases of cars, boats and cabins and to finance home improvements. These categories and the *tenants* category are the largest categories measured by number of households (see Table 1).

In 2015, close to 90 000 households bought a dwelling, either their first home or a subsequent home, compared with close to 70 000 in 2010. This is an increase of almost 30 percent, whereas the total number of households increased by close to 7 percent. The number of secondary home owners with rental income increased substantially, by more than 40 percent.

Table 1. Statistics by category in 2010 and 2015. In 1000s of households and 1000s of 2015 NOK, unless otherwise specified.

	Number of households		Average debt		Change in debt	
	2010	2015	2010	2015	NOK 1000	%
All aged 20-90	2044	2181	945	1160	215	23
First-time buyers aged 20-34	19	25	1836	2044	208	11
Home movers aged 20-90	49	62	2400	2818	418	17
Secondary home owners aged 20-90	37	53	2451	3066	615	25
Younger owners aged 20-44	404	435	1742	2131	385	22
Older owners aged 45-64	492	544	1121	1444	324	29
Pensioners with own homes aged 65-90	290	341	303	413	110	36
Tenants aged 20-90	554	596	244	260	16	6
Others aged 20-90 ¹	198	125	1057	1084	27	3
¹ Households not assigned to one of the seven analysis categories.						
Sources: Statistics Norway and Norges Bank						

Average debt is highest in the *secondary home owner* and *home mover* categories. These categories also have the highest increase in average debt in NOK between 2010 and 2015. The debt increase in percent is highest in the *pensioner* and *older owner* categories. Average debt, however, is still low in these categories, particularly among pensioners. The increase in average debt for first-time buyers is relatively modest.

4. Decomposition analysis

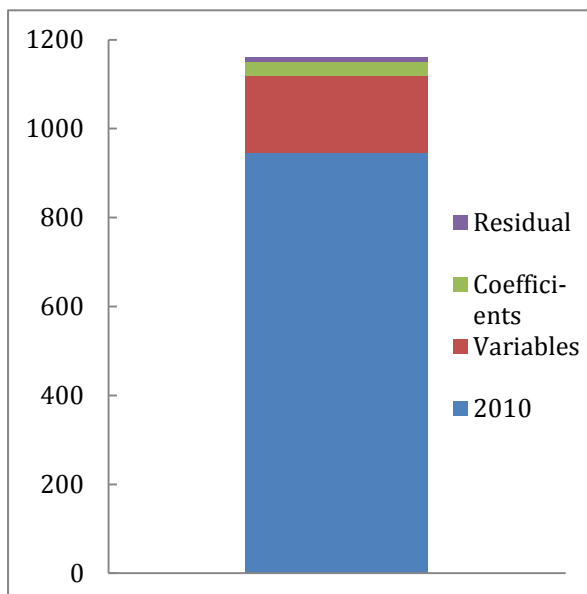
In general, the distribution of the debt increase across the three factors, variables, coefficients and the residual factor, and also across the various explanatory variables, will depend on the model specification. The explanatory variables and the model specification were selected to accommodate observation at household level and the relatively high explanatory power of the cross-section estimates on data for 2010 and 2015.

4.1. All households

Using the data for all households, the model explains approximately 40 percent of the variation in household debt in both 2010 and 2015 (Appendix 2). Average debt is close to NOK 1 million in 2010 and close to NOK 1.2 million in 2015 (Table 1), an increase of NOK 215 000.

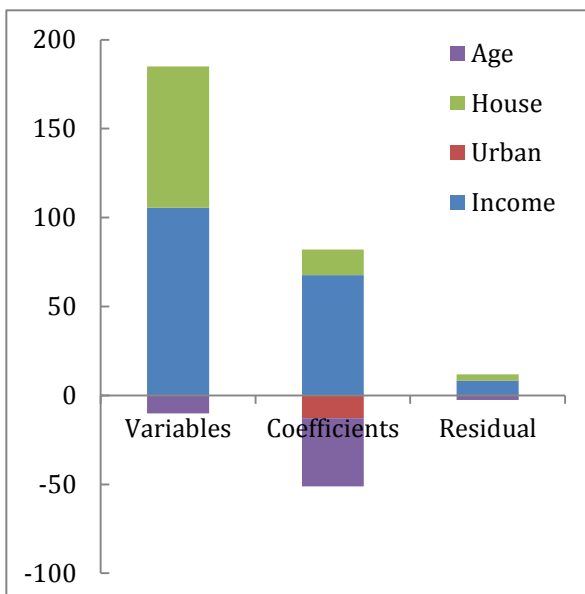
The results show that a good 80 percent of the increase in average debt, ie NOK 175 000, can be attributed to developments in the variables (Chart 1). A good 14 percent, NOK 31 000, can be attributed to changes in estimated coefficients, while the residual contribution is small.⁸

Chart 1. Average debt in 2010 and debt increase 2010-2015 decomposed by factor. All households, aged 20-90. In 1000s of NOK



Sources: Statistics Norway and Norges Bank

Chart 2. Average debt increase 2010-2015 decomposed by the variable for each factor¹. All households, aged 20-90. In 1000s of NOK



¹ In the coefficient column, the sum of changes in the constant term and age dummy variables is included in Age.

Sources: Statistics Norway and Norges Bank

⁸ The main picture is robust if we decompose the difference in debt using 2015 as the base year rather than 2010, ie if in equation (3), 2010 is replaced throughout by 2015 and 2015 by 2010.

The decomposition of the factor contributions by variable shows that higher income and housing equity represent 60 percent and 46 percent, respectively, of the total variable contribution; age composition makes a slightly negative contribution (Chart 2). The demographic composition of households has shown a moderate change and shifts have offset each other. An increase in the share of households aged between 25 and 35 and between 45 and 55, for example, has been offset by a decline in households aged between 35 and 45.

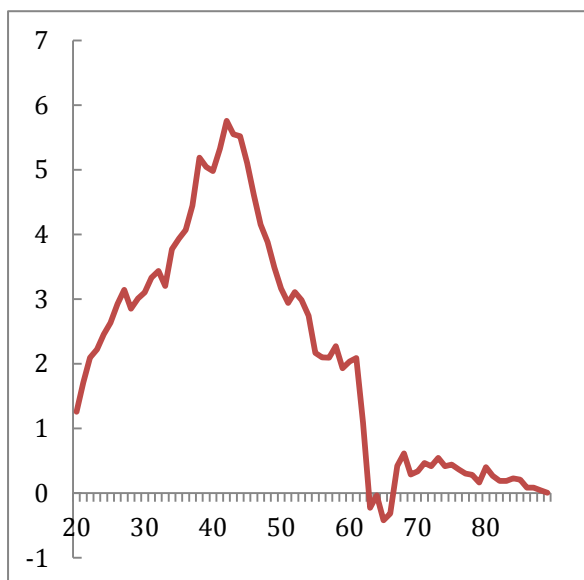
Ideally, a household-specific interest rate should have been included as an explanatory variable in the debt equation. The data set does not include such interest rates, but an implicit interest rate for indebted households has been calculated, defined as interest expenses as a share of average debt over the past two years. Regressions that include this variable show that this interest rate explains very little of the increase in average debt from 2010 to 2015. The effect is generally not significant. The median value of the estimated implicit real interest rate fell modestly by 0.26 percentage points between 2010 and 2015. During this period, banks' average mortgage rate rose at first, but fell steadily from the end of 2013. Most household debt is secured on dwellings and more than 90 percent of residential mortgage loans are floating-rate loans. Consequently, for most households, the mortgage rate tracks general interest rate developments.

The coefficient contributions show that households as a whole have increased their borrowing related to income in particular and have only to a limited extent increased their borrowing related to the value of the dwelling. This is in line with the conclusions in Anundsen and Mæhlum (2014). Dwellings are generally considered low-risk collateral and provide households with easier access to credit. The regulation on banks' residential mortgage lending, which was first issued as guidelines, contains maximum loan-to-value (LTV) ratios and requirements relating to debt-servicing capacity. Increased borrowing related to income and to the value of the dwelling indicates that much of the rise in debt between 2010 and 2015 was in households that were able to satisfy the regulatory requirements, i.e. a required capacity to service debt in the event of a 5 percentage point increase in interest rates and a total LTV ratio of less than 85 percent. A somewhat lower mortgage interest rate in 2015 contributed to strengthening household debt-servicing capacity.

The age-specific constant terms comprise the constant term and the coefficients of the age dummy variables. These are added together in the coefficient contributions. Debt, income and housing wealth vary systematically over the different stages of the life cycle, and to the extent income, housing wealth and rural/urban location do not systematically reflect variations in debt, this will be captured by the included age dummy variables. Chart 3 shows that the change in each coefficient on the detailed age dummy variables is generally small. The largest contribution to the increase in debt is just over NOK 6000. However, the total contribution from the age coefficients, which is calculated by summing across all age groups, is relatively considerable and

positive. A decline in the constant term dominates and gives a negative effect from the coefficients in age as a whole.

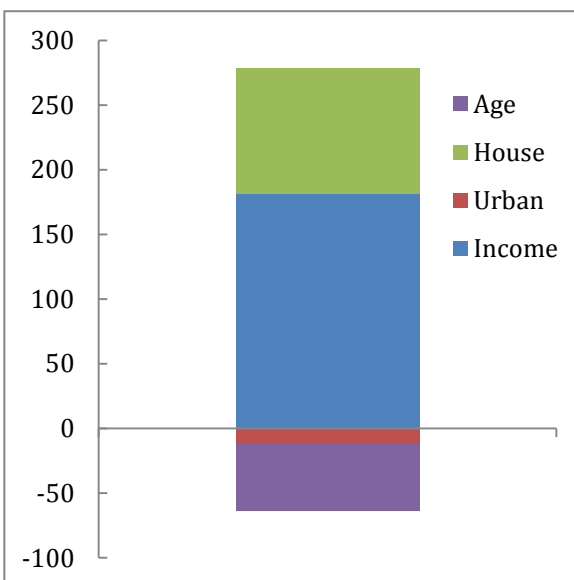
Chart 3. Contribution to debt increase 2010-2015 from change in age dummy variables for each year¹. All households, aged 20-90. In 1000s of NOK



¹ The total coefficient effect from the age dummy variables is calculated by cumulating across all age groups.

Sources: Statistics Norway and Norges Bank

Chart 4. Average debt increase 2010-2015, decomposed by variable.¹ All households, aged 20-90. In 1000s of NOK



¹ Age, including change in constant term.

Sources: Statistics Norway and Norges Bank

The total effect of the various variables shows that income in particular, but also the value of the dwelling, have contributed to the rise in average debt between 2010 and 2015 (Chart 4). Age, ie mainly the total effect of the constants in the model, has contributed negatively.⁹ The combined effect of changes in location within and outside the urban areas of Oslo, Bergen, Trondheim and Stavanger is also negative, but is of little significance.

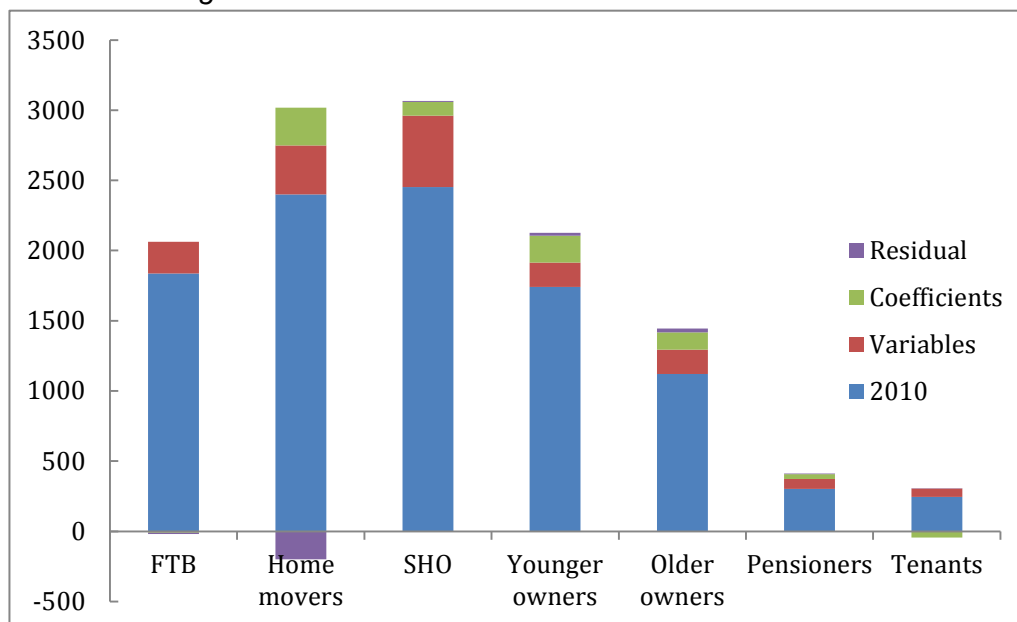
4.2. Household categories

Changes in the variables explain a significant part of the increase in average debt for all categories (Chart 5). This is most evident in the first-time buyer and secondary home owner categories. For all categories, apart from tenants, higher house values account for a large share of the variable-based debt increase (Chart 6, first bar in all panels). As expected, this is most pronounced among buyers, whether this is their first home or a subsequent home. Increased income is of substantial significance for most categories. The

⁹ Here, demographic changes, which are small, have been merged with the changes in the constants.

exception applies to both categories of buyers, ie first-time buyers and home movers.

Chart 5. Average debt in 2010 and debt increase 2010-2015 decomposed by factor for categories of households. In 1000s of NOK



FTB: First-time buyers, aged 20-34; Home movers: Homeowners that buy a new dwelling, aged 20-90; SHO: Secondary home owners with rental income, aged 20-90; Younger owners: Homeowners aged 20-44 that do not buy a new dwelling; Older owners: Homeowners aged 45-64 that do not buy a new dwelling; Pensioners: Homeowners with pension as their main income, aged 65-90; Tenants: Households that do not own their own home, aged 20-90.

Sources: Statistics Norway and Norges Bank

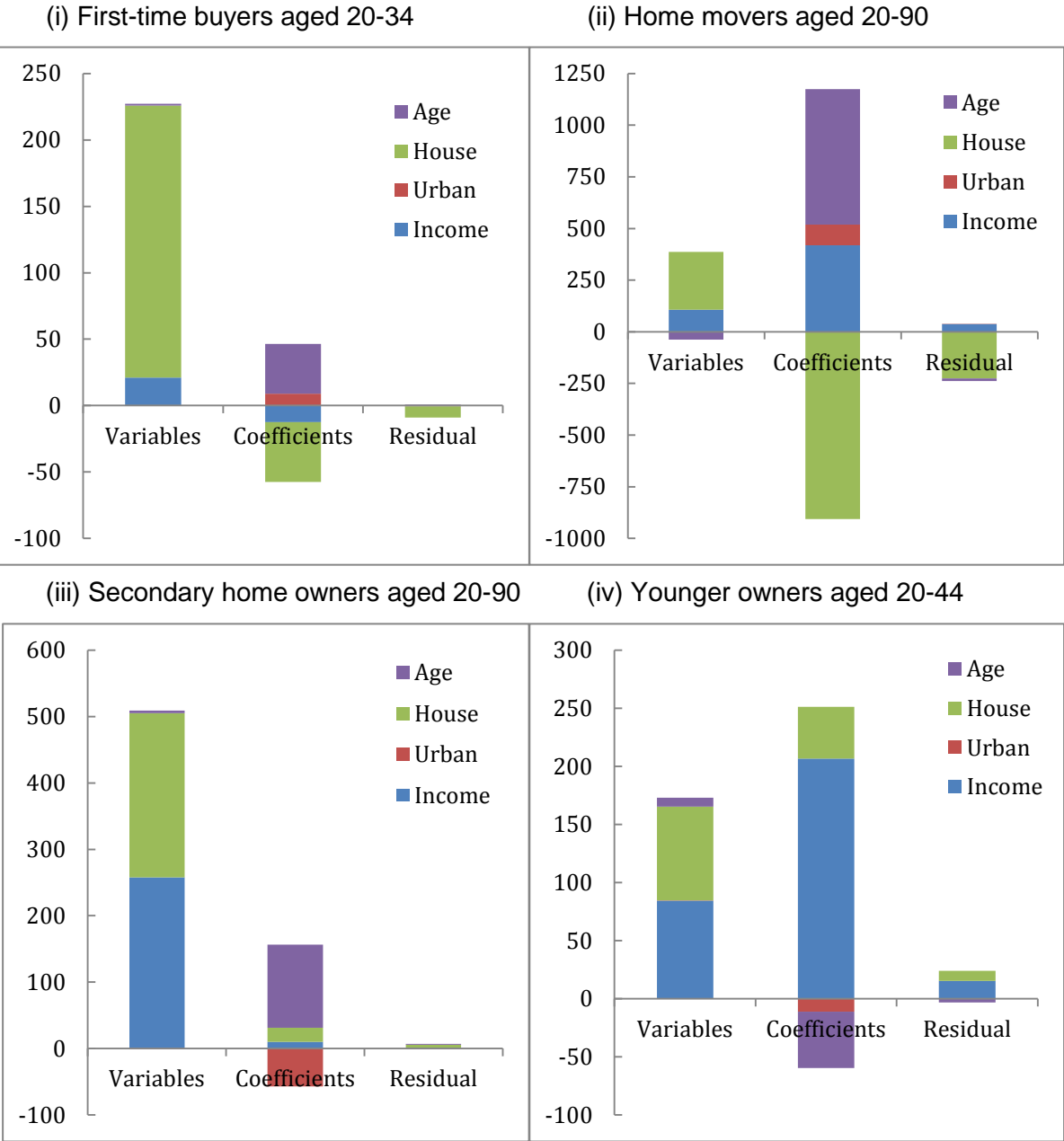
For several categories, the change in the estimated coefficients also has a substantial effect. Typically, this effect is a sum of both negative and positive changes and has, on the whole, a more complicated structure than the variable effect. For example, the total coefficient effect for first-time buyers is close to zero, but this conceals a clear negative effect linked to dwellings and a positive effect linked to the age dummy variables (Chart 6(i)).

The coefficient on dwellings also shows a clear negative effect for home movers (Chart 6(ii)). Borrowing related to house value was lower for home movers in 2015 than for home movers in 2010, which may indicate that the regulation of banks' residential mortgage lending, first as guidelines and then as regulatory requirements, has had an impact.¹⁰ Home movers have more

¹⁰ A split of home movers into three age groups, 20-44, 45-65 and 66-90, further supports this assessment. In periods of rising house prices, available collateral value for homeowners will generally increase the longer it is since the home purchase. On the whole, older owners will have more available collateral than younger owners, and borrowing by younger owners is therefore expected to be constrained to a greater extent by regulatory caps on LTV ratios. The results for households in the category with the youngest home movers show a relatively large reduction in borrowing related to the value of the dwelling. The results for middle-aged households show an opposite

collateral backing their loans. Other categories have increased their borrowing related to house value, but these categories must be assumed to have available collateral value.

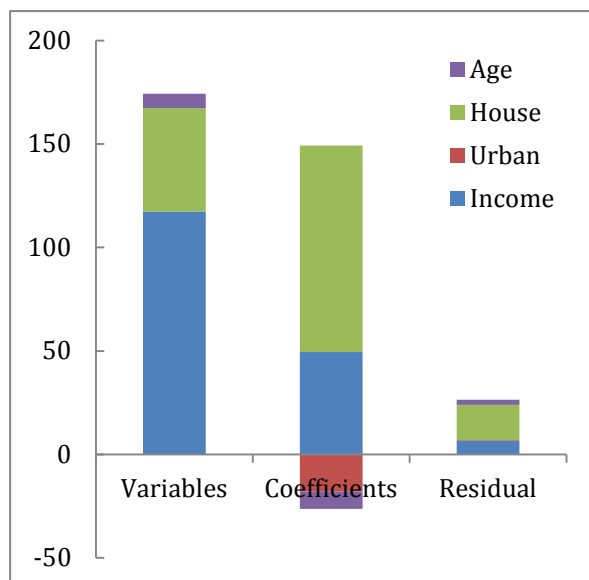
Chart 6. Average debt increase 2010-2015 decomposed by variable for each factor. For different categories. In 1000s of NOK



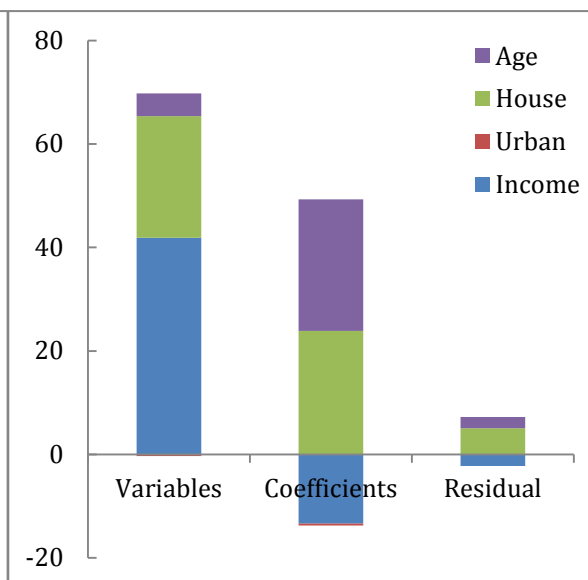
pattern – although the change is smaller. Home-owning pensioners that buy a new home have also reduced their borrowing related to the value of the dwelling to some extent.

Chart 6. cont.

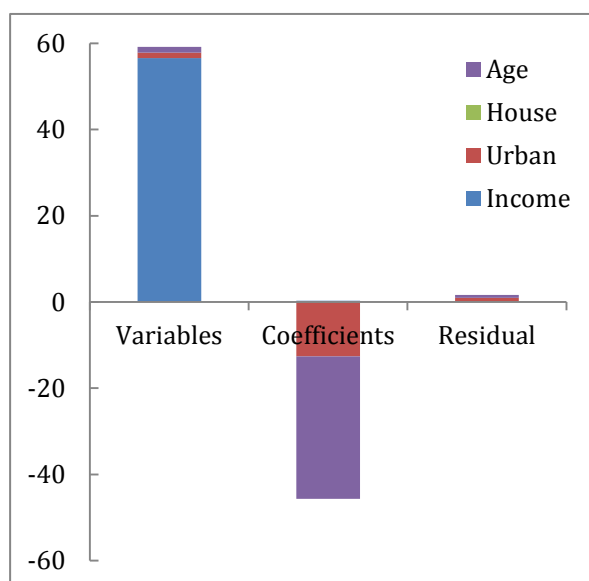
(v) Older owners aged 45-64



(vi) Pensioners with own homes aged 65-90



(vii) Tenants aged 20-90



Sources: Statistics Norway and Norges Bank

The coefficient on dwellings also shows a clear negative effect for home movers (Chart 6(ii)). Borrowing related to house value was lower for home movers in 2015 than for home movers in 2010, which may indicate that the regulation of banks' residential mortgage lending, first as guidelines and then

as regulatory requirements, has had an impact.¹¹ Home movers have more collateral backing their loans. Other categories have increased their borrowing related to house value, but these categories must be assumed to have available collateral value.

Most of the categories have increased borrowing related to income, but for pensioners and, to a certain extent, first-time buyers, the opposite is true. Increased borrowing related to income means that households are more vulnerable to interest rate increases and reduced income. The constant terms, ie *Age* in the *Coefficients* bar in Chart 6, capture the systematic change in average debt that is not linked to explanatory variables other than age. For most of the categories, the total effect of the constant term and age dummy variables is positive; the exceptions are both of the owner categories and the tenant category. For these categories, this factor contributes to reducing average debt irrespective of income and house value and represents a general reduction in the willingness or ability to borrow.

For home movers, despite the increase in average house value, the reduction in the coefficient of this explanatory variable between 2010 and 2015 gives as a result a significant negative residual effect (Chart 6(ii) third bar). This is the main reason for the aggregated negative residual effect for this category in Chart 5. As previously explained, this category includes a wide range of both ages and behaviours, and the negative correlation between increased house value and borrowing related to house value is clearest among the older households in this category.

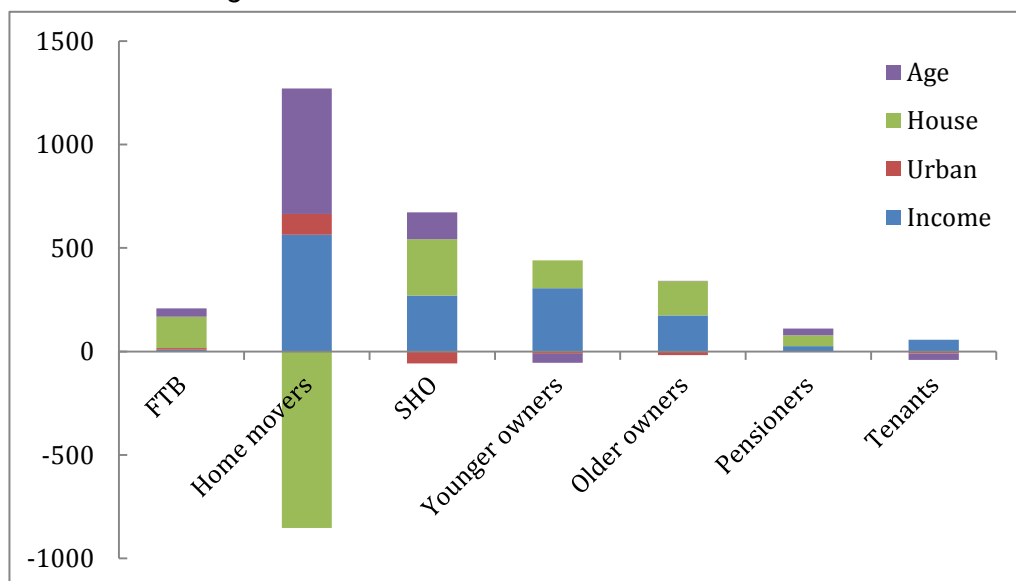
The total effect by variable shows that income contributes significantly for several categories (Chart 7). For most households, this reflects both higher income and increased borrowing related to income. For first-time buyers, however, increased income plays only a minor role.

The variable for house value explains a substantial part of the debt increase for most of the categories. The only real exception is home movers, for whom there is a negative correlation between the value of the dwelling and debt.¹² Home movers will often sell a dwelling and buy another in the same year. Consequently, the overall effect of higher prices on borrowing is uncertain. These findings may mean that higher house prices result in lower borrowing for this category, but could also reflect a choice to use accumulated financial assets to finance the purchase of a new home.

¹² This is also in line with Anundsen and Mæhlum (2017), who find that for buyers in 2014, debt relative to the value of the dwelling was lower, but debt relative to income was higher than for buyers in 2009. However, their results are not based on a decomposition of the debt and the debt increase.

¹² This is also in line with Anundsen and Mæhlum (2017), who find that for buyers in 2014, debt relative to the value of the dwelling was lower, but debt relative to income was higher than for buyers in 2009. However, their results are not based on a decomposition of the debt and the debt increase.

Chart 7. Average debt increase from 2010 to 2015 decomposed by variable for different categories. In 1000s of NOK



FTB: First-time buyers, aged 20-34; *Home movers*: Homeowners that buy a new home, aged 20-90; *SHO*: secondary home owners with rental income, aged 20-90; *Younger owners*: Homeowners that do not buy a new home, aged 20-44; *Older owners*: Homeowners that do not buy a new home, aged 45-64; *Pensioners*: Homeowners with pension as their main income, aged 65-90; *Tenants*: Households that do not own a dwelling, aged 20-90.

Sources: Statistics Norway and Norges Bank

For most categories, urban households pull down the increase in average debt somewhat between 2010 and 2015, but among first-time buyers and home movers, urban households push up average debt. Urban buyers in 2015 borrowed on average more, irrespective of income, wealth and age, than urban buyers in 2010. This may be related to the fact that urban buyers buy relatively more expensive dwellings owing to higher house prices, and that they have less accumulated equity relative to the purchase amount and thus must borrow more. Increased house prices between 2010 and 2015 may have amplified this effect. This may also reflect greater confidence that house prices will continue to rise in urban areas, resulting in an increased willingness and ability to borrow.

Except for buyers, the change in age dummy variables and constant terms, ie the age variable, only explains the increase in average debt to a modest extent.

5. Conclusion

Using a statistical method, the increase in average household debt in the period between 2010 and 2015 is decomposed by variables, such as income, house values and the distribution of the population across different stages of the life cycle, and changes in the willingness and ability to borrow.

The data used combine household income statistics compiled by Statistics Norway and information on home purchases from the Norwegian Mapping Authority's national property registry. The analysis is conducted on data for all households aged between 20 and 90 and on seven sub-samples based on stages of the life cycle and position in the housing market. The decomposition shows considerable variation in the debt pattern across the categories.

The analysis shows that for households as a whole, debt growth between 2010 and 2015 to a great extent reflects higher income and higher house values. Among first-time buyers, increased average debt can on the whole be attributed to higher house prices. House prices were higher in 2015 than in 2010.

At the same time, the analysis shows that other factors may have contributed to curbing household debt growth. First-time buyers' borrowing related to the value of the dwelling declined in this period and contributed to reducing the rise in their average debt. The same applies to younger home movers. First-time buyers have also reduced their borrowing related to income. This is in line with the expected effect of the new regulation setting stricter requirements for residential mortgage loans.

References

Anundsen, A.K. and S. Mæhlum (2017): “Regional differences in house prices and debt”. *Economic Commentaries* [4/2017](#), Norges Bank.

Jahn, B. (2008): “The Blinder-Oaxaca decomposition for linear regression models”. *The Stata Journal* [8\(4\)](#): 453-479.

Halvorsen, E. and K.-G. Lindquist (2017): “Getting a foot on the housing ladder: The role of parents in giving a leg-up”. [Working Paper No. 19](#), Norges Bank.

Lindquist, K.-G., H. Solheim and B.H. Vatne (2017): “Household debt and links to the housing market. Consequences for financial stability”. *Economic Commentaries* [7/2017](#), Norges Bank.

Norges Bank (2017): [Financial Stability Report 2017](#). Norges Bank.

Appendix 1. The data

The analysis is based on a combination of household income statistics compiled by Statistics Norway (based on tax assessment data from the Norwegian Tax Administration) and information on home purchases from the Norwegian Mapping Authority's national property registry. Households are defined as persons living in the same unit. The age of a household is determined by the age of the main income earner.

The analysis is delimited to households aged between 20 and 90. Self-employed persons are excluded. In each cross-section for 2010 and 2015, households that belong to the one percent with the highest pre-tax income or the one percent with the highest gross financial assets are excluded. Households with pre-tax income lower than the National Insurance Scheme basic amount (G) are also excluded.

The Norwegian Mapping Authority's data on housing transactions are delimited to registered property purchased for residential purposes. For 2015, the data set covers approximately 2.2 million households and 91 000 housing transactions. For these housing transactions, the price paid by the buyer, ie the actual market price, is used. The value of the dwelling for other households is the estimated market value based on tax assessment data. For particularly attractive properties, these estimated market values could be lower than the actual market value.

The analysis examines changes between 2010 and 2015. The year 2010 was selected as a base year because the manner in which house values are determined in tax assessment data was changed in 2010, and because the basis for comparing home ownership before and after 2010 is limited.

Appendix 2. Estimation results

Table A1 shows estimates and standard deviations for selected coefficients and adjusted R^2 for the cross-sectional regressions by category for 2010 and 2015.

Table A1. Cross-sectional regression results by category for 2010 and 2015. The left-hand side variable is $Debt_i$ ^{1,2}

Category i	$t = 2010$				$t = 2015$			
	$Income_i$	$House_i$	$Urban_i$	$Adj.R^2$	$Income_i$	$House_i$	$Urban_i$	$Adj.R^2$
<i>All</i>	1.76 (.003)	.221 (.000)	-56628 (1593)	.395	1.90 (.003)	.231 (.000)	-105164 (1816)	.422
<i>First-time buyers</i>	1.53 (.027)	.570 (.006)	19041 (9427)	.517	1.50 (.024)	.547 (.005)	41194 (8861)	.511
<i>Home movers</i>	1.80 (.025)	.404 (.004)	-72193 (14910)	.378	2.43 (.023)	.078 (.002)	286520 (16006)	.304
<i>Secondary home owners</i>	2.25 (.041)	.267 (.004)	-90713 (26567)	.293	2.26 (.029)	.271 (.003)	-287566 (23456)	.352
<i>Younger owners</i>	1.83 (.007)	.222 (.002)	40381 (3582)	.231	2.16 (.006)	.246 (.002)	1586 (4065)	.279
<i>Older owners</i>	1.40 (.006)	.129 (.001)	40052 (3680)	.206	1.48 (.005)	.174 (.001)	-40191 (4189)	.239
<i>Pensioners</i>	.697 (.007)	.052 (.001)	35840 (2747)	.095	.661 (.006)	.063 (.001)	34021 (3145)	.099
<i>Tenants</i>	1.49 (.005)	..	-53822 (1874)	.192	1.50 (.004)	..	-93498 (1977)	.208

¹ Estimated coefficients. Standard deviations in parenthesis. All regressions also include constant terms and age-specific dummy variables.

² Number of observations equals the number of households in Table 1.