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STAFF MEMO

House prices and household consumption

NO. 11 | 2017

MORTEN HAABETH
GRINDAKER



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Morten Haabeth Grindaker¹

HOUSE PRICES AND
HOUSEHOLD CONSUMPTION

Neither standard economic theory nor empirical studies provide an unequivocal answer to the question of the effect of changes in house prices on household consumption. Estimating this effect empirically is demanding because both house prices and consumption are influenced by a number of common factors that are difficult to measure. Norwegian studies of the relationship between house prices and consumption have until now been based on time series for the country as a whole. In this article, I investigate the relationship between house prices and consumption using empirical analysis based on Norwegian data at the county level. The results suggest that there is a significant positive correlation between developments in house prices and household consumption. The estimated effects are consistent with the results of more recent studies based on national data for Norway, but are slightly weaker than the results of similar research in other countries.

Key words: Consumption, house prices, panel data.

1. Introduction

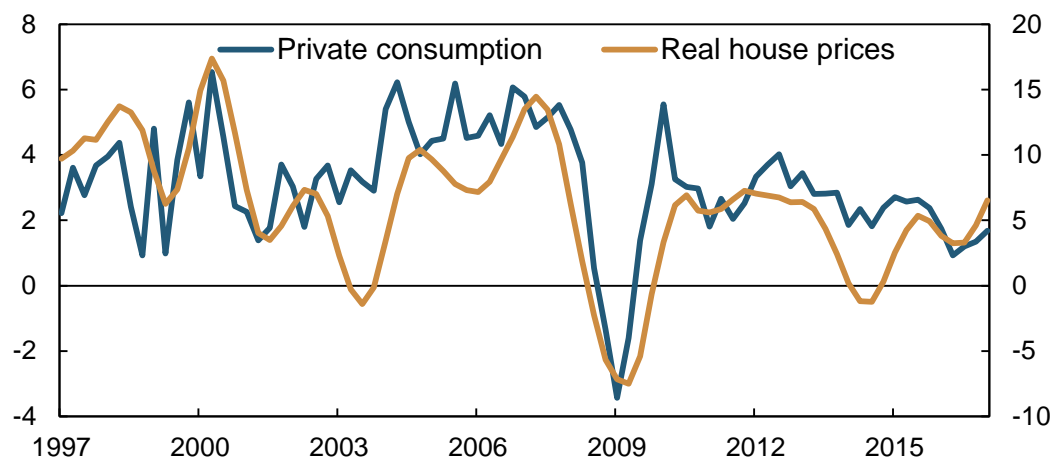
Private consumption accounts for around half of mainland GDP in Norway, and changes in consumption can therefore have a considerable impact on economic developments. Thus, it is important to understand the factors influencing household consumption. This article discusses the role played by house prices in consumption developments.

Over the past 20 years, Norwegian house prices have risen sharply. On average, real house prices have increased by over 6 percent annually. At the same time, house price inflation has varied considerably over this period. Growth in household consumption appears to correlate with house price inflation in Norway over time (Chart 1).² It is important to clarify whether this historical correlation is primarily driven by underlying factors or whether house prices in themselves have a material effect on consumption.

¹ The views and conclusions expressed in this publication are those of the author and do not necessarily reflect those of Norges Bank. This article should therefore not be reported as representing the views of Norges Bank. The author would like to thank Kåre Hagelund, Bjørn Naug, Andreas Kostøl, Martin Holm, André Anundsen, Ingrid Solberg and Per Espen Lilleås for valuable input and comments. Special thanks go to Einar Nordbø for input and comments throughout the process of writing this article. Any errors or omissions are solely the author's responsibility.

² The correlation coefficient between house price inflation and growth in consumption is approximately 0.6 in the period between 1997 and 2017. Similar correlations have been demonstrated in a number of countries.

Chart 1: Private consumption (left-hand scale) and real house prices (right-hand scale). Four-quarter change. Percent. 1997 Q1 – 2017 Q2



Sources: Statistics Norway and Norges Bank

There are several possible explanations for the observed correlation between house prices and consumption. Changes in house prices affect the value of total household wealth. If the amount of household wealth is a crucial factor in determining household consumption, higher house prices can pull up consumption by increasing the housing wealth of homeowners. In Norway, seven out of ten households own their own home, and the market value of household housing wealth accounts for around two-thirds of total household wealth.³ However, a number of recent studies indicate that the effect of wealth changes on consumption per se is relatively modest.

A related mechanism is the effect of the value of dwellings on the ability of households to borrow. When household housing wealth rises, households can increase their mortgage borrowing. Similarly, falling house prices can reduce access to credit and force many households to reduce consumption. Several international studies published since the financial crisis have highlighted this mechanism.⁴

However, the clear correlation between house prices and consumption does not necessarily signify a causal relationship between the two variables. Underlying factors may be driving developments in both house prices and consumption. Household housing demand and household consumption are influenced by factors such as interest expenses, income expectations, access to credit and unemployment.

³ The figures are for 2015. In addition, just over one out of ten households owns a secondary dwelling (see page 96 of Statistics Norway's *Økonomiske analyser 1/2017* (in Norwegian only)). In 2015, the dwellings owned by private households in Norway had an estimated market value of NOK 5 629 billion (see Table 6.5 in *Økonomiske analyser 1/2017*. Statistics Norway (in Norwegian only)).

⁴ See eg Mian et al (2013) and Aron et al (2011)

As some of these common factors are difficult to measure, many empirical analyses do not control for all of these factors.

In this article, I focus on the relationship between house prices and consumption and perform a new empirical analysis based on regional data for Norway. Until now, studies of the relationship between house prices and consumption in Norway have primarily been based on time series for the country as a whole. The regional data set makes it possible to control for national driving forces that are difficult to capture in time series analyses based on data for the country as a whole.

I find a significant, positive correlation between house prices and a range of indicators of household consumption in general and after controlling for developments in national driving forces and county-level unemployment, income and debt growth. The analysis suggests that when house prices decline by 10 percent, car and retail sales decrease by 2 percent. The effect on total consumption is likely to be lower than this, since both car and retail sales vary more over time than total consumption. Based on the correlation between the consumption indicators I employ and total consumption, the results suggest that consumption is reduced by approximately 0.5 percent when house prices fall by 10 percent. These estimates are slightly lower than the results of similar international studies conducted since the financial crisis, but consistent with new time series analyses of data for Norway.

2. What does economic theory tell us?

To assess how changes in house prices can influence consumption, I begin with the behaviour of an individual household. The household can spend its income and wealth on two goods: housing H and consumption C .⁵ In each period, the household can buy and sell housing H_t at price P_t , choose consumption C_t on the basis of income Y_t and wealth W_t . Net wealth also includes the housing wealth that the consumer has already acquired $P_t H_t$. The cost of owner-occupation R_t depends on the household's expectations regarding changes in the price of the dwelling, the degree of depreciation and interest expenses.⁶

⁵ A review based on the same framework can be found in eg Aron et al (2011) and Iacovelli et al (2011).

⁶ If a household prefers to own a dwelling, the dwelling must be purchased at price P_t . In the following period, the dwelling has depreciated by $(1 - \delta)$ and can be sold at price P_{t+1} discounted by $\frac{1}{1+r}$. The total cost of owning the dwelling will thus be: $(P_t - \frac{(1-\delta)}{1+r} P_{t+1})H_t$. This total cost is often referred to as a homeowner's implicit user cost $R_t \equiv (P_t - \frac{(1-\delta)}{1+r} P_{t+1})$, where interest expenses are included less any tax deduction (see eg Poterba (1984). Household consumption, as measured in the national accounts, includes consumption of

If, for the sake of simplicity, it is assumed that the household expects constant house prices and prefers to smooth consumption over the life cycle⁷, the household's budget constraint can be written as:

$$C + RH = \frac{r}{1+r} (PH_0) + Y^P$$

The equation above states that a household's expenditure on consumption C and housing RH must be equal to the present value of the household's lifetime resources. This includes the present value of housing wealth $\frac{r}{1+r} (PH_0)$ and the present value of future income Y^P . The effect on consumption of a permanent change in the price of the dwelling can thus be written as:

$$\frac{\partial C}{\partial P} = \frac{r}{1+r} H_0 - \frac{r+\delta}{1+r} H - \frac{\partial H}{\partial P} R$$

(+)
(+)
(-)

Change = Wealth effect – income effect – substitution effect

The equation states that the effect on consumption of a permanent fall in the price of the dwelling can be decomposed into a wealth effect, an income effect and a substitution effect.

Wealth effect: Permanently lower house prices result in lower household wealth over the life cycle. A rational consumer will distribute this decline across all consumption periods.

Income effect: Lower house prices will enable a given income to stretch further. When house prices are lower, households can buy more housing/a larger dwelling and increase other consumption. This effect suggests that lower house prices result in higher consumption.

Substitution effect: A permanent fall in house prices makes a home purchase relatively less expensive and the consumer will therefore shift or *substitute* towards housing and away from other consumption. This effect suggests that lower house prices will result in lower consumption.

housing services, which for homeowners is estimated on the basis of observable rentals for similar dwellings.

⁷ This assumption is based on a presumption that households' subjective discounting is equal to the return on savings, so that the marginal utility of consumption today is equal to the marginal utility of saving for consumption in the following period. The assumption of constant house prices is made only to illustrate the individual effects more easily and is also used in the framework in Aron et al (2011).

Since the above-mentioned effects pull in different directions, this theory does not yield a clear answer to the question of how changes in house prices will influence consumption for an individual household. The picture becomes even more blurred if we look at households in the aggregate. In this case, it will no longer be reasonable to consider house prices as given variables, as in the above framework. It is particularly debatable whether operating with wealth effects of house prices is reasonable when the household sector is considered as a whole. According to Buiter (2008), a fall in house prices will primarily redistribute wealth from households planning to trade down in the housing market to households planning to buy into or trade up in the housing market. This redistribution of wealth will only have an effect on consumption if there are differences in the different households' propensity to consume.⁸

The theory above does not take account of the constraints on households' ability to borrow. In practice, the ability to borrow depends on both household income and household wealth. These credit constraints can amplify the effects of house prices on consumption. When household housing wealth rises, households can increase their mortgage borrowing. If house prices fall, many consumers' access to credit will be constrained by lower collateral values. Credit-constrained households are likely to adjust consumption more in the event of changes in wealth and income than other households. Recent theoretical studies, which take account of these effects, show that changes in house prices can have a substantial effect on consumption.

3. What do empirical studies show?

The results of studies on the estimated effect of house prices on private consumption vary relatively widely. Results from Norway and other countries indicate that a 10 percent fall in house prices can reduce consumption by between 0 and 6 percent. This variation reflects the difficulty of distinguishing house price effects from other factors affecting consumption and differences in the approach used to isolate the house price effect empirically. In addition, there are signs that household debt ratios, which tend to vary over time and across countries, have a bearing on the magnitude of the effect.

⁸ Kaplan et al (2016) argue that the wealth effect of the fall in house prices in the US during the recession is an important reason behind the subsequent reduction in consumption. According to the authors, the wealth effect results in lower consumption because households planning to trade down in the housing market account for a larger share of total consumption than households planning to trade up.

The percentage change in consumption when house prices change by 1 percent is often referred to as the elasticity of consumption to house prices. Most empirical studies look at the relationship between consumption and the value of household housing wealth and not directly at house prices. However, since variations in house prices are the most important source of short-run variation in housing wealth, whether house prices or housing wealth are included in the model will likely have little impact on the results.

3.1. Research on time series data

Many of the studies that attempt to estimate the effect of house prices on consumption utilise time series models which control for other observable factors. The remaining correlation between consumption and house prices over time is interpreted as the effect of house prices on consumption. All of the Norwegian studies reported from in Table 1 below can be regarded as variants of this approach.

The international studies include Catte et al (2004), Lettau and Ludvigson (2004) and Hamburg et al (2008). In these time series studies, consumption elasticity is estimated at between 0 and 0.3, ie a 10 percent decline in house prices results in between 0 and 3 percent lower consumption. Some of the difference in the estimates probably reflects differences in the explanatory variable employed: Catte et al (2004) use housing wealth, while Hamburg et al (2008) and Lettau and Ludvigson (2004) use the value of total wealth (Table 1). Housing wealth is only a portion of total wealth. The effect on consumption of a change in house prices will therefore be less pronounced than the wealth effect estimated by Hamburg et al (2008) and Lettau and Ludvigson (2004).

Of the Norwegian studies, Brodin and Nymoene (1992) find the highest elasticity. Here, the value of total household wealth is used as the explanatory variable. A 1 percent increase in total wealth is estimated to increase consumption by 0.27 percent. The results in Brodin and Nymoene (1992) are based on data up to and including 1989. The effect on consumption of changes in total wealth is estimated to be less pronounced in similar studies using more recent data (see eg Eitrheim et al (1998), Erlandsen and Nymoene (2008) and Jansen (2012)). Studies using Norwegian data that distinguish between household housing and financial wealth conclude that changes in housing wealth have a smaller impact on consumption than changes in financial wealth. Both Andersen et al (2016) and Landsem (2016) find that a 10 percent fall in housing wealth reduces consumption by just below 1 percent.

The challenges presented by these studies are that the estimated house price effects may be the result of factors not controlled for in the estimation or that there are underlying factors camouflaging the actual relationships. These will typically be explanatory factors that are difficult to quantify, such as income expectations and access to credit. For example, Aron et al (2011) find that the positive effect of house prices on consumption disappears when changes in access to credit are controlled for. Bank of England (2016) points out that the effects of house prices on consumption in microstudies are small compared with the effects reported in studies on aggregated data. This is interpreted as an indication that the house price effects found in simple time series analyses are to a great extent driven by omitted variables.

So-called structural VAR models may be better suited to controlling for underlying explanatory factors.⁹ Jarocinski and Smets (2008) use such a model on US data from the period 1987 to 2007. They find a consumption elasticity of 0.08, which is somewhat lower than several of the simple time series analyses using US data. In sum, this suggests that there is a need for caution in interpreting the findings from the above-mentioned time series analyses as causal relationships.¹⁰

3.2. Research on panel data

The relationship between house prices and consumption has also been studied using panel data, ie data over time for several areas of the estimation. Such data sets have a number of advantages. The time series in question can often be fairly short, either because of a lack of data or because using long time series is difficult owing to structural changes. If the variation across areas is also used, the number of observations increases, which can contribute to more precise estimates. At the same time, using panel data makes it possible to control for the effects of omitted variables that are common to all areas. As pointed out above, it is difficult to quantify developments in access to credit. However, developments in this factor may be fairly similar across regions within a country. If so, it will be possible to control for this factor by using panel data. However, in studies of house prices and consumption, the limited availability of reliable consumption data at regional level is a disadvantage.

⁹ To identify the relationships in analyses of this type, an assumption is normally made about the structure of the relationships between the variables. The models will only be better suited if the restrictions imposed provide a correct picture of the causal relationships.

¹⁰ See also Iacovelli and Neri (2010). They show that the correlation between housing wealth and consumption in the US can to a large extent be replicated in a model where both variables are driven by changes in preferences, technology and monetary policy.

Case, Quigley and Shiller (2005) arrive at a consumption elasticity of 0.11 for a panel of 14 countries and 0.08 for a panel of US states. They use retail sales figures as an indicator of regional consumption in the US. Campbell and Cocco (2007) construct a regional measure of consumption in the UK based on consumption surveys. They find an aggregated consumption elasticity of 0.6. This high level of consumption elasticity appears to depend on the manner in which they construct the data set and the time period they use. In a similar study, Attanasio et al (2009) find a consumption elasticity of 0.2 when the correlation is measured over a longer time horizon and other measures of consumption are used.¹¹

Panel data do not solve all the challenges presented by studies of house prices and consumption. The ideal situation is to find a reliable instrument for house prices, ie a variable that affects house prices, but does not in itself have any effect on consumption. Mian et al (2013) make use of the considerable differences across US urban areas in the degree to which topographical factors are a constraint on housing construction. This means that a given change in demand for housing will have different price impacts depending on the area. At the same time, they argue that topographical variation in itself does not affect consumption and can therefore function as a so-called instrument variable for house prices. On this basis, they find a consumption elasticity resulting from changes in housing wealth of 0.6 in the period 2006 to 2009. Registered new car sales and transaction data from MasterCard are used as indicators of consumption. It is possible that the effects on these indicators are more pronounced than on consumption overall. In a re-estimation of this study, Kaplan et al (2016) use retail sales figures as a consumption indicator instead. This results in an elasticity of between 0.24 and 0.36, approximately half of the effect arrived at by Mian et al (2013).

A number of studies point out that the effect of house prices on consumption is influenced by the level of household debt. Since debt ratios will vary over time and across countries, this indicator can also help to explain the variation in the estimated effects of house prices. Among international studies, Mian et al (2013), for example, show that US households with high debt ratios reduced consumption more than other households when house prices fell. For Norwegian households,

¹¹ Attanasio et al (2009) argue that the positive correlation between house prices and consumption must primarily be attributed to the influence of future income expectations on both variables. They find that house prices have the most pronounced effect on the consumption of young households. If the correlation were driven by a wealth effect, the oldest households should have shown the most pronounced positive reaction to higher house prices.

Yao, Fagereng and Natvik (2015) find that that the effect on consumption of changes in housing wealth is amplified by the level of debt. Lindquist, Solheim and Vatne (2016) argue that a fall in house prices in Norway can affect household consumption because the value of a dwelling is an important factor in household borrowing.¹²

4. Regional analysis of Norwegian data

This section examines the relationship between house prices and consumption in Norway using county-level data. The procedure is the same as in the international panel data studies. To my knowledge, no similar study on Norwegian data has been conducted before. As for many other countries, adequate data for consumption at regional level in Norway are not available.¹³ In the analysis, annual data for new car sales and retail sales at county level are used as indicators for the effect on private consumption. Both indicators are correlated with developments in private consumption and together provide information about developments in consumption.¹⁴

The analysis examines the relationship between regional changes in real house prices and regional changes in new car and retail sales. The empirical question is “What percentage change in consumption indicators is associated with a 1 percent change in house prices?” By including dummy variables in the estimation, often referred to as time-fixed effects, I control for any omitted variables that are common to all Norwegian counties. In addition, I control for changes by county in unemployment, gross income, net migration, housing investment and debt. The control variables have been chosen on the basis of the variables used in similar international studies and the available data.

¹² According to Lindquist, Solheim and Vatne (2016), more than 10 percent of household spending in Norway in 2014 excluding home purchases was financed by borrowing secured on the value of the dwelling.

¹³ Consumption reported in Statistics Norway's (SSB) county accounts is broken down by county based on a derivation from disposable income in the county and does not provide independent regional information about consumption.

¹⁴ See the Appendix for a description of the correlation between the consumption indicators and developments in private consumption and a description of the data set.

Table 1: Estimated consumption elasticity¹⁵ to changes in wealth, housing wealth and house prices

	Study	Data	Consumption measure	Explanatory variable	Elasticity
Norway	Brodin and Nymoen (1992)	Time series (1968-1989)	Private consumption	Net wealth	0.27
	Eitheim et al (2002)	Time series (1968-1998)	Private consumption	Net wealth	0.23
	Jansen (2012)	Time series (1970-2008)	Private consumption	Net wealth	0.15
	Erlandsen and Nymoen (2008)	Time series (1968-2004)	Private consumption	Net wealth	0.17
	Andersen et al (2016)	Time series (1994-2015)	Private consumption	Housing wealth	0.07
	Landsem (2016)	Time series (1985-2015)	Private consumption	Net housing wealth	0.08
International	Catte et al (2004)	Time series for 10 OECD countries (1980-2003) ¹⁶	Private consumption	Net housing wealth	0.01-0.08
	Lettau and Ludvigson (2004)	Time series US (1951-2003)	Non-durable consumption	Net wealth	0.08 -0.3
	Hamburg et al (2008)	Time series Tyskland (1980-2003)	Non-durable consumption	Net wealth	0.2-0.3
	Jarocinski and Smets (2008)	Time series US (VAR) (1987-2007)	Private consumption	House prices	0.08
	Case, Quigley and Shiller (2005)	Panel data (14 countries)	Private consumption	Housing wealth	0.11-0.14
			Retail sales	Housing wealth	0.05-0.09
	Calomiris et al (2009)	Panel data (US states)	Retail sales	Housing wealth	0 – 0.02
	Mian et al (2013)	Panel data (US postal codes)	Transaction data from MasterCard and car sales	Net housing wealth	0.6
	Kaplan et al (2016)	Panel data (US postal codes)	Retail sales	Net housing wealth	0.24-0.36
	Campbell and Cocco (2005)	Panel data UK	Consumer survey	House prices	0.58
Attenasio et al (2009)	Panel data UK	Consumer survey	House prices	0.16	

¹⁵ Elasticity denotes the percentage change in consumption when the explanatory variable changes by 1 percent.

¹⁶ Time periods vary across countries, from 1963 for Canada to 1988 for Australia.

The equations estimated for car sales (1) and retail sales (2) are as follows:

- 1) $\Delta car\ sales_{it} = \alpha_i + \beta_1 \Delta house\ prices_{it} + \beta_2 \Delta house\ prices_{it-1} + \beta_3 inward\ migration_{it} + \beta_4 \Delta Income_{it} + \beta_5 \Delta unemployment_{it} + \beta_6 \Delta debt_{it} + \beta_7 T + \varepsilon_{it}$
- 2) $\Delta retail\ sales_{it} = \gamma_i + \delta_1 \Delta house\ prices_{it} + \delta_2 \Delta house\ prices_{it-1} + \delta_3 inward\ migration_{it} + \delta_4 \Delta Income_{it} + \delta_5 \Delta housing\ investment_{it} + \delta_6 \Delta unemployment_{it} + \delta_7 \Delta debt_{it} + \delta_7 T + u_{it}$

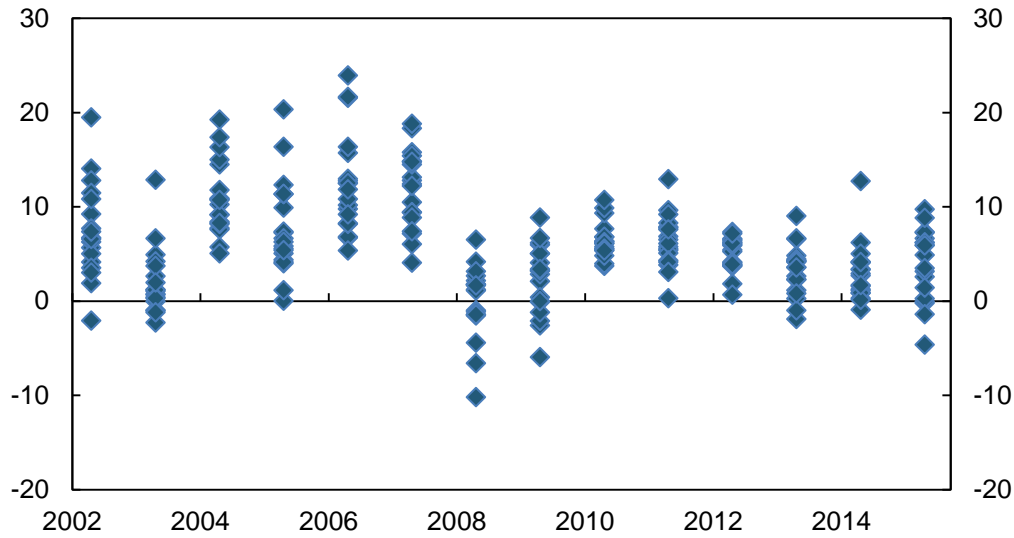
Both car sales and retail sales are divided by the county's population. Sales, house prices, income and debt are deflated by the CPI to obtain real values. Variables in italics indicate that the logarithm of the variable is used. In the analysis, common factors are controlled for by year-fixed effects. All control variables are included both contemporaneously (t) and with a one-year lag (t-1). In the analysis I also control for so-called fixed-area effects. This entails permitting the various areas to have different constant terms. Any trend differences in consumption growth across counties owing to factors I do not control for can be captured by the fixed-area effects.

Chart 2 below shows the considerable regional variation in the annual change in prices for existing homes in the ten-year period between 2002 and 2016.¹⁷ In 2008, house prices fell in most counties, but the annual change varies from a 10 percent fall to a 4 percent rise. In the period since the oil price decline in 2014, house price inflation in Norway has shown wide regional variation. House price inflation has been low in many counties in southwestern Norway, while house prices in several counties in eastern Norway have risen by more than 15 percent (Chart 3).

Chart 4 below shows annual changes in car sales and real retail sales, respectively, and real house prices for all counties in the period 2002-2015. There is a weak, but significant, positive correlation between changes in house prices and changes in retail sales and a strong significant correlation between changes in house prices and car sales before controlling for other factors.

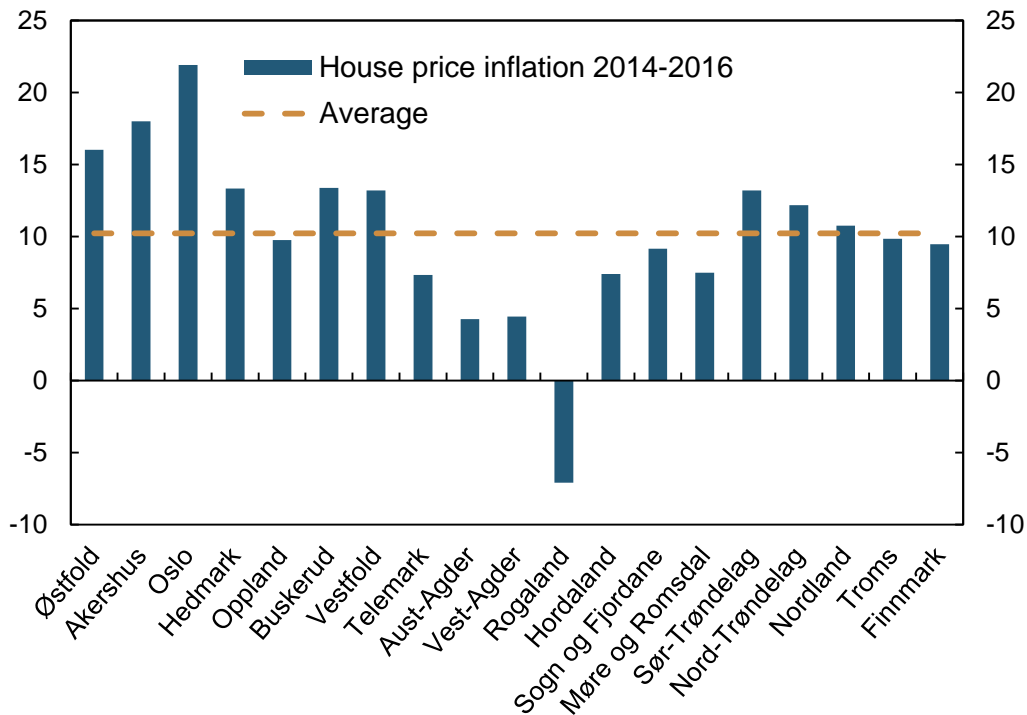
¹⁷ The analysis uses the average price per square metre for existing single-family dwellings according to SSB because this is the most common type of dwelling in all counties except Oslo. However, the series shows less price variation over time than the average price per square metre of eg units in multi-dwelling buildings and is probably a less accurate reflection of the price variation over time in Oslo, where the share of single-family dwellings is small compared with units in multi-dwelling buildings.

Chart 2: Existing home prices by county. Average price per square metre. Annual change. Percent. 2002-2015



Sources: Statistics Norway and Norges Bank

Chart 3: Existing home prices by county. Average price per square metre. Nominal change 2014 - 2016. Percent



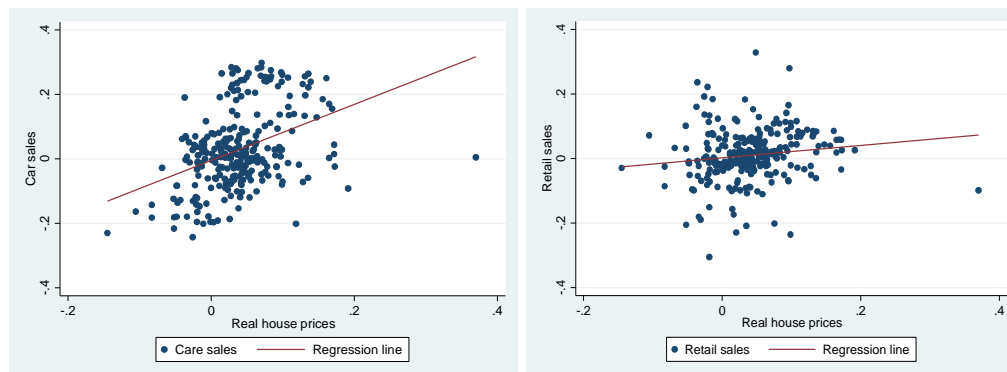
Sources: Statistics Norway and Norges Bank

Chart 4: Change in car and retail sales associated with changes in house prices. 2002-2015.

The charts on the left and on the right show annual changes ($\Delta \log$) in car sales and real retail sales, respectively, and real house prices for all counties in the period 2002-2015. The plot and the regression line are weighted by county population.

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Sources: Bisnode, Statistics Norway and Norges Bank

4.1. Results

The empirical analysis shows that the correlation between house prices and consumption indicators is also significant when additional explanatory variables are included in the estimation.

Table 2 shows the results of the estimated correlation between changes in house prices and changes in car sales. In the first two columns, house prices are the only explanatory variable. In column 1, the estimated effect of house prices is strong. The estimated effect is reduced considerably when fixed-year effects are included in the estimation (column 2). Now the regression shows that car sales per capita decline by approximately 0.2 percent when house prices decline by 1 percent. The effect is little changed when income, net inward migration, unemployment and debt by county are also controlled for (columns 3 to 5) and the time period is extended. The results indicate that the correlation between house prices and consumption at county level is to a large extent due to common, national driving forces, which is captured in the estimate by the fixed-year effects. The results also indicate that house prices do not affect car sales immediately, but with a one-year lag. Higher house prices can reasonably be expected to take time to affect car sales, especially if higher house prices affect car sales through the ability of households to increase their mortgage borrowing.

Table 2: Results of panel data regressions on car sales

Dependent variable: Car sales per capita	1	2	3	4	5
House prices	0.869***	0.038	-0.004	-0.112	0.041
House prices (t-1)	0.02	0.217***	0.203**	0.219**	0.229**
Income			1.520*	1.271*	1.557**
Income (t-1)			-0.447	-0.772	-1.012
Unemployment			-0.045**	-0.050**	-0.038*
Unemployment (t-1)			0.015	0.014	0.013
Inward migration				-1.219	-1.503
Inward migration (t-1)				-0.468	-0.739
Debt				-0.061	0.118
Debt (t-1)				-0.351	-0.080
Time-fixed effects	No	Yes	Yes	Yes	Yes
County-fixed effects	No	No	Yes	Yes	Yes
Observations	266	266	247	247	266
R ²	0.16	0.85	0.87	0.87	0.87
Period	2002-2015	2002-2015	2002-2014	2002-2014	2001-2014

All variables except for debt, net inward migration as a share of the population and unemployment are included in log-change form. Since registered unemployment is given as a percentage, it is included only in change form. The standard errors in the regression are clustered by county to take account of the series correlation. ***, ** and * indicate significance at the 1, 5 and 10 percent level. As a robustness check, a regression has also been performed of model five to take account of panel-specific autocorrelation in the error terms. The effect of house prices (t-1) in this specification is also significant at the 5 percent level. The effect of house price changes in column 1 is much stronger when the estimation begins in 2002 than when the estimation begins in 2001. In 2001, the annual car tax was increased, and this change appears to have contributed to weaker car sales in that year. However, the time period that is included has little bearing when fixed-year effects and other control variables are controlled for (column 5).

The correlation between house price changes and retail sales is also significant. Table 3 shows the results from the estimation of house price changes and retail sales. The effect is significant for all specifications, and the size of the estimate changes little after controlling for income, net inward migration, unemployment, housing investment and debt. The results suggest that retail sales are reduced by 0.2 percent when house prices fall by 1 percent.

In addition to house prices, unemployment and income have a significant effect on retail sales. However, when year-fixed effects are also controlled for, only the effect of changes in income is significant. Since few of the regional control variables are significant and the model only explains 28 percent of the variation in retail trade, the results should be interpreted with caution. However, the estimated effect is on approximately the same scale as the effects on US retail sales found by eg Kaplan et al (2016) and is significant when different sets of control variables are used (see note to Table 3).

Table 3: Results of panel data regressions on retail sales

Dependent variable: Retail sales	1	2	3	4	5	6	7
House prices	0.206**	0.176**	0.145*	0.190***	0.194***	0.186***	0.173***
House prices (t-1)							0.041
Income		0.015	-0.114	-0.985	-1.085	0.443	-0.222
Income (t-1)							2.237***
Unemployment			-0.022***	0.006	-0.022	0.001	0.007
Unemployment (t-1)							0.015
Housing starts					-0.015	-0.022	-0.002
Housing starts (t-1)							0.003
Inward migration						0.936	0.497
Inward migration (t-1)							0.757
Debt							0.089
Debt (t-1)							-0.437
Time-fixed effects	No	No	No	Yes	Yes	Yes	Yes
County-fixed effects	No	No	No	No	No	Yes	Yes
Observations	304	304	304	285	285	285	266
R ²	0.04	0.03	0.05	0.24	0.23	0.24	0.28
Period	2000- 2015	2000- 2015	2000- 2015	2001- 2015	2001- 2014	2001- 2014	2001- 2014

All variables except for debt, net inward migration as a share of the population and unemployment are included in log-change form. Since registered unemployment is indicated as a percentage, it is included only in change form. The standard errors in the regression are clustered by county to take account of the series correlation. ***,** and * indicate significance at the 1, 5 and 10 percent level. As a robustness check, a regression has also been performed of model seven to take account of panel-specific autocorrelation in the error terms. The effect of house prices is also significant in this specification at the 1 percent level. As a robustness check, I have also compiled a series for retail sales that adjusts for product groups where the construction industry and government authorities account for a relatively large share of sales. The effect of house prices is also significant (and somewhat stronger) when I use the adjusted series. In addition, I have also carried out the same estimation for retail sales, but including changes in completed dwellings in year t and year t+1 rather than housing starts. The effect of house prices is still significant when autocorrelation in the error terms in the estimation is also taken into account. However, the estimate is somewhat lower: 0.17 compared with 0.19. Analyses have also been performed using wage income rather than median gross income and including housing market turnover, without materially changing the estimated effect of house prices.

Overall, the estimated effects indicate that changes in house prices influence consumption. In order to judge what the correlation between the consumption indicators and house prices means for the effect on total consumption, a rough estimate can be made of the correlation between growth in private consumption and growth in car sales and retail sales in the estimation period. A simple regression between growth in private consumption and growth in retail sales and car sales

suggests that the estimated effects above result in a total consumption elasticity of approximately 0.05 percent.¹⁸

However, the results do not provide a basis for the conclusion that there is a causal relationship between house prices and consumption. The observed correlation could be due to factors that have not been controlled for in the analysis, such as regional differences in income expectations and the perception of uncertainty. I have not attempted to construct an instrument variable for house prices in this study, but this could be an interesting avenue for future research.¹⁹

5. Summary and conclusion

Following a period of rapid house price inflation, house price developments in Norway have been weaker in recent months. This prompts the question of the impact of house prices on the wider economy. This article investigates the relationship between house prices and consumption using empirical analysis based on county-level data for Norway.

Although earlier studies have shown that house prices can have a substantial impact on consumption, the estimated effects vary. Results from Norway and other countries indicate that a fall in house prices of 10 percent can reduce consumption by between 0 and 6 percent.

Norwegian studies of the relationship between house prices and consumption have up to now primarily been based on times series for the country as a whole. This article presents a new analysis of this relationship based on regional data for Norway. The regional data set makes it possible to control for national driving forces that are difficult to capture in time series analyses based on data for the country as a whole. I find a significant, positive correlation between changes in house prices and changes in car and retail sales. The analysis suggests that when house prices decline by 10 percent, car and retail sales decrease by 2 percent. The effect on total consumption is probably lower than this as both car and retail sales vary more over time than total consumption. Based on the correlation between the consumption indicators I employ and total consumption, the results suggest that

¹⁸ The regression shows that a 1 percent change in retail sales is associated with a 0.18 percent rise in consumption, while an equivalent change in car sales is associated with a 0.08 percent rise in consumption.

¹⁹ Bjørland (2017) has compiled data on available areas for housing development in regional Norway that could potentially act as an instrument for house prices, as in Mian et al (2013). However, such an analysis would also require the construction of consumption indicators and other relevant explanatory variables for the regions.

consumption is reduced by approximately 0.5 percent when house prices fall by 10 percent.

The observed correlation may be due to underlying county-level factors that have not been controlled for. Nonetheless, the correlation indicates that house prices provide important information about developments in consumption, whether this is the result of direct effects or due to underlying factors that are not quantifiable. In periods of falling house prices, there is ample reason to expect that consumption growth will be relatively weak.

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Appendix

A. The data set

Car sales: Annual new vehicle registrations according to the “Opplysningsrådet for veitrafikken” (OFV, an independent organisation to promote road traffic safety) in the period 2000-2016 as a share of county populations as recorded by Statistics Norway (SSB). Regional car sale data from OFV show the number of cars sold, but not their value. If higher house prices primarily lead to an increase in the value of the cars purchased by households rather than an increase in the number of cars, this will not be captured by our analysis. Historically, however, the value of car purchases has closely tracked the number of car sales.

New car purchases accounted for just over 5 percent of total private consumption in 2012. However, household car purchases are an important component of consumer durables, which are probably the most cyclically sensitive segment of private consumption. Chart 5 shows the four-quarter change in national car sales and private consumption. The correlation between the variables in the period 2001 Q1 to 2017 Q2 is about 0.6, indicating that car sales can provide information about developments in total consumption.

Retail sales: Operating income for retail trade (NACE code 47 – retail trade, except of motor vehicles and motorcycles) based on company accounts information recorded in the official Register of Company Accounts at Brønnøysund, sourced from Bisnode. Turnover figures provided by the individual firms are grouped at municipal level based on the firm’s organisation number in the Brønnøysund Register. The data are then aggregated to county level and cover about 16 000 firms. The variable is divided by the CPI to obtain real values and by the population of the county. A variable excluding hardware, paints and glass and pharmaceuticals is also constructed.

Changes in retail trade turnover are also correlated with changes in private consumption, although not to any considerable degree (Chart 6). However, the correlation between annual growth in operating income in the retail trade sector and annual growth in household goods consumption is stronger, at about 0.6. There are several reasons why the correlation between annual growth in operating income in the retail trade sector and goods consumption is not stronger. One reason is that retail firms’ customers are not limited to households, but also include other firms, the public sector and foreign tourists. Sales of hardware, paints and glass and pharmaceutical sales, for example, accounted for

11 percent of retail sales, but less than 2 percent of goods consumption. Another reason is that goods consumption also includes the non-retail purchase and use of cars, electricity and fuel. To avoid the problem of corporate sector purchases, we have also constructed a series excluding components important to the construction industry and the public sector.

A simple regression between annual growth in private consumption and growth in car and retail sales in the period 2001-2015 shows that the consumer indicators can explain about 50 percent of the variation in consumption. The regression shows that a 1 percent change in retail turnover is associated with a rise in consumption of 0.18 percent, while a corresponding change in car sales is associated with a 0.08 percent rise in consumption.

House prices: Average prices per square metre for existing single-family dwellings according to SSB divided by the consumer price index (CPI) in reference year 2015 as provided by SSB. In the analysis, we use SSB statistics for the average price per square metre for existing single-family dwellings as this is the most common type of housing in all counties except Oslo. However, the series shows less price variation over time than the average price per square metre of eg units in multi-dwelling buildings and is probably a less accurate reflection of the price variation over time in Oslo, where the share of single-family dwellings is small compared with units in multi-dwelling buildings.

Income: Median gross income based on SSB tax statistics divided by the CPI. We use measures of median income rather than average income because changes in median income are probably more representative of the majority of households. High-income households would pull up the average and the measure of average income would thereby provide a less representative picture of developments in household income.

Unemployment: Registered unemployment by county. Sources: Norwegian Labour and Welfare Administration and Statistics Norway.

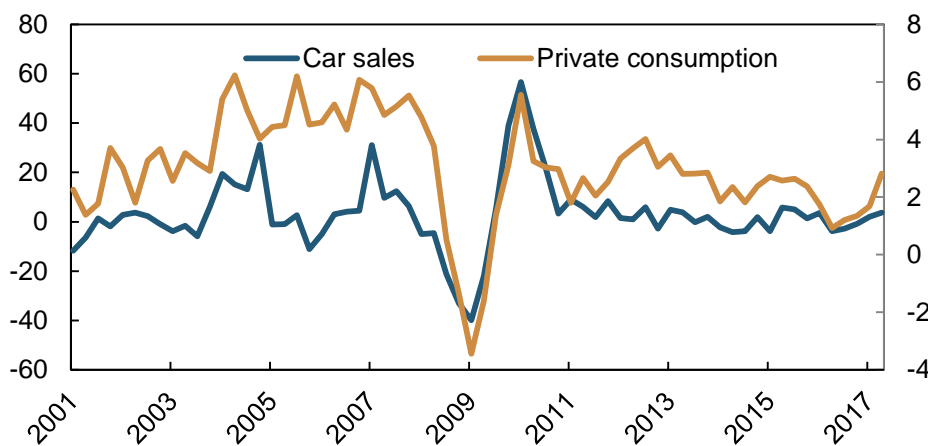
Inward migration: Net inward migration as a share of the county's population. Source: Statistics Norway. To control for increases in demand as a result of net inward migration that could influence both house prices and consumption, we use net inward migration as a share of the county's population.

Housing investment: Housing starts in square metres and completed dwellings in square metres as a share of the county's population. Source: Statistics Norway. A possible source of error in the estimation may be that retail turnover is driven by purchases related to housing construction in the county and not by the effect of house prices on household goods consumption. To limit this problem, we control for

county-wise changes in housing starts. We have also constructed a series for retail turnover adjusted for product groups where the construction industry and the public sector account for a relatively large share of turnover. The effect of house prices is also significant (and somewhat stronger) when we use the adjusted series. The same estimation was also performed for retail turnover, but including changes in completed dwellings in year t and year $t+1$ rather than housing starts. The house price effect is still significant when autocorrelation of the error terms in the estimation is also taken into account.

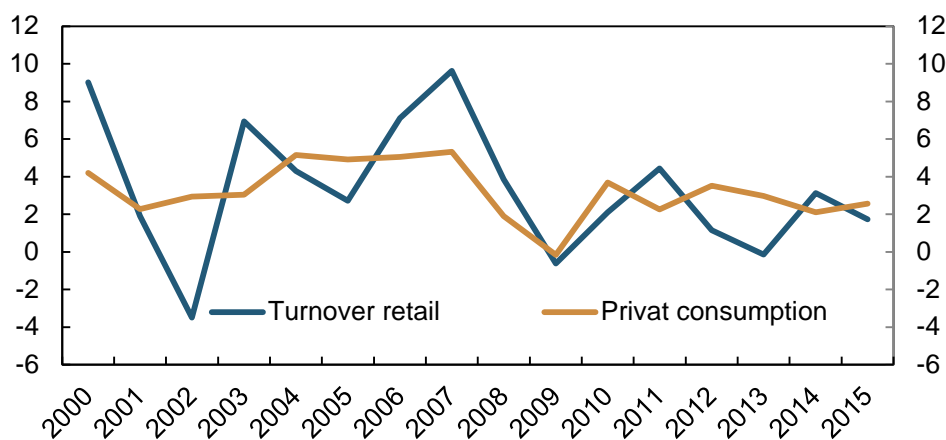
Debt: Average debt based on SSB tax statistics divided by the CPI.

Chart 5: Number of car sales (left hand scale) and private consumption (right-hand scale). Volume. Four-quarter change. Percent. 2001 Q1 – 2017 Q2.



Kilder: Opplysningsrådet for vegtrafikken (OFV) og Statistisk sentralbyrå

Chart 6: Retail turnover and private consumption. Volume. Annual change. Percent. 2000 – 2016



Kilder: Bisnode og Statistisk sentralbyrå