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Fluctuations and Stability in the Danish Housing Market: Background, Causes and Policy

Abstract.
The Danish house prices have been through strong boom and bust cycles the last 30 years. The house price changes are into a high degree explained by the changes in interest payments and in taxes. Denmark has more than 100 years tradition for taxation of owner-occupiers' imputed rent, but the proceed has followed the house prices and been in a range at ½ to 1% of GDP. At three tax reforms the tax rate for deduction of interest expenses has been reduced. After a slow deregulation and liberalisation the last 10 years the Danish mortgage industry through innovations has created several new products, mostly with short-term interest rates. The net interest expenditure/income ratios for the owner-occupiers have been relatively stable since 1994 and as the interest rates have dropped and half of the debtors had re-mortgaged to adjustable-rate mortgages (with "low" interest rates), the owner-occupiers debt had been increasing. The risk for the owner-occupiers is discussed and is especially linked to their debt. However, the debt had not increased more than the house prices, as the net liability/housing wealth ratios have been nearly stable since 1987. Actually a start to a "bubble" in the house prices is identified. The expectation environment believe on higher rates of increase in house prices than in consumer prices. From 1998 on, the former positive correlation between house prices and the private consumption has been changed, and herd behaviour as well as the new mortgage products are among the possible causes.

Keywords: owner-occupation, housing market, house prices, housing cycles, housing taxation, housing finance, housing wealth / income ratios, financial stability.
JEL classifications: D 14, E 31, E 32, G 21, R 20, R 31.

1. Introduction

An international house price rise and household debt race is going on. Denmark is placed among the European countries with the second strongest house price inflation. Denmark is one of the countries in Europe with the most effective mortgage market but also with the largest mortgage debt per capita compared with GDP.

In general housing consumption is determined through the general economic conditions. The free access to efficient and low cost financing of the properties is of high importance for the market. Similar the tax and housing policy burden the owners and set some general limits. Also for the owner-occupation rate, in Denmark 52% of the housing stock and a little more than 60% of the inhabitants. Besides the direct influence on the market for owner-occupied houses and flats the housing and tax policy exercise an indirect impact through the rent regulation over more than a half century and direct support to other tenures.

The unchanged average owner-occupation rate cover, the tenure has been on retreat among the younger families – below 50 years of age! – and had only increased moderately among the older generations. These changes mostly appeared through the ”housing market failure” 1987-1993 and had not been reversed through the years after with steep rising house prices. Disregarding the influence of the aging of the population, the average owner-occupation rate would have dropped to 50.2% in 2002 (Lunde, 2005a).

Table 1.
Owner-occupation rate for families in different age groups. 1987-2002. Per cent.

Year	Age, years: <30	30-39	40-49	50-59	60-69	>70	All
1987	27.2	58.6	69.1	66.6	59.3	43.5	52.8
1994	20.8	52.0	63.7	68.5	63.3	45.6	51.1
2002	17.7	50.8	62.5	68.5	66.6	46.7	52.2

Mostly the income after tax and the building costs seem to determine the house prices at the long term. Contrary at the short term, strong boom and bust cycles with a large amplitude are observed. At result the house prices at the short term are into a high degree determined by the taxation and financial conditions for owner-occupied dwellings.

Since 1903 the imputed rent of the owner-occupied dwellings have been taxed in Denmark, however since 2000 as a property value tax. Besides, the owner-occupiers as well as other private persons and companies can deduct the interest expenses in the taxable income. Three tax reforms have reduced the tax rate for private persons at the deducting. At the two first tax reforms the tax on the imputed rent was lowered in the same degree, but at the change to the property value tax, the tax level was maintained. The tax reforms have made home ownership more expensive.

An opposite effect has appeared from the financial system and especially for mortgages as the falling interest rates and the financial deregulation have made it less expensive to stay in owner-occupied dwellings. A part of the reduction in the housing expenditures has been cosmetic as being a consequence of new loan types with short-term interest and interest-only facilities.

In these years, the expectations among the owner-occupiers and the population are changing rather quick. The years with steep rising house and flat prices have created expectations on permanent

capital gains above the general inflation. The nearly unbroken chain of interest drops down to a ”historical low” interest rate level has contributed to create common expectations on that the interest rates can not increase pronouncedly. A lot of signs on herd behaviour has been observed among people in relation to owner-occupation. It will be made plausible that Denmark is at a start to a ”bubble” in the house prices, just as a ”bubble” in the flat and in the summer cottage prices seems to exist already. However, a proof for a ”bubble” seems unrealistic.

It seems hardly possible – among the owner-occupiers themselves and among others – to meet any response on that even though the owner-occupiers have been wealthier at receiving a capital gain through a house price rise they have at same captured an increased liability, as the owners' net present values of the future user costs have increased similarly.[1] And only few housing consumers realize that investments in houses, flats and summer houses are risky.

In parallel and in pure theory, the risk for families, who already are owner-occupiers, is not that the house prices drops, because the net present value of the future housing services also drops. Contrary the owner-occupiers' risk is connected with their debt. Traditionally, the Danish mortgage loans have had a fixed interest rate, where even a minor increase in the market interest rate lead to strong drop in the price for the loan (the market value of the debt). After the introduction of interest-adjusted loans in 1996, these types covered 46% of the owner-occupiers' mortgage debt at the entrance to 2005. The market value of these mortgages is nearly unchanged even at large interest rates changes, as they are financed by selling short-term bonds.

In the last part of the paper the main results from a new study on the owner-occupiers' capital structure and interest payments are mentioned (Lunde, 2005b). The years 1987-2002 covered at first a ”housing market failure” and from 1993 on, the steep house price rise took off. The owner-occupiers' capital structure has been nearly the same through the period. From1994 on the housing wealth/income as well as the net liability/income ratios have been rising, and at the entrance to 2005 these ratios are at an all-time-high. From 1987 to 1994 the owner-occupiers' net interest expenditures before tax compared with their gross income dropped, but after 1994 they have been nearly unchanged. However, the interest expenditures after tax were at the same high level in 2002 as back in 1987. In conclusion, Denmark does not seem to be better prepared on a new ”housing market failure” than back in 1987, when the last failure started. Of course, no crystal ball is in front of us, telling the probability for a new “housing market failure”.

2. House prices – down and up

2a. Actual changes

In the European house price rise competition, Denmark was placed among the “Strong inflation countries”, the silver medal group, *“which in 2004 had annual price rises hovering around the 5% rate in real terms”*. Moreover, together with France and against the stream, Denmark experienced increases in the house price inflation rate. (Ball, 2005, Chap. 1).

This impression is confirmed by looking at the last years increases in average m^2-prices for single family houses as presented in Table 2. The latest statistical knowledge is on a rate just below 10%. Besides the general inflation in consumer prices has dropped a little, while economic growth has prospered again.

[1] Going that line out, the heritage and the heirs' wealth as well as creditors' and debtors' positions at financing must be included.

Table 2.
Annual increase in house prices, consumer prices and real growth rate. 2001-2004.

	House price rise the Association of Mortgage Banks q4 – q4. Per cent.	Consumer price index Statistics Denmark Nov.– Nov. Per cent.	Real growth rate, GDP Statistics Denmark / Central bank Year-year. Per cent.
2001	6.7	1.9	1.6
2002	2.4	2.7	1.0
2003	5.3	1.5	0.4
2004	9.2	1.3	2.0

Denmark has in reality the same interest rate conditions as in the euro-area. The taxation and other economic conditions for the owner-occupied dwellings have only been marginally changed. The lower interest rates have lead to additional re-mortgaging, and the new interest-adjusted loan types are seen as "inexpensive" by the debtors. Therefore the view can not be excluded that the late jump up to a higher real rate of increase in the house prices is one of the first sign on a "bubble" in the Danish house prices.

Important differences in the house price rise among the regions and the towns are ongoing. During the later years the house price rise has been strongest in the capital with the most expensive houses and flats and in some provincial growth centres, while the house price rise has been moderate in town with industry with low productivity increases and in general decreasing with lowering degree of urbanisation. From 2003q4 to 2004q4 the increase in the m^2-price was 12.9% for owner-occupied flats, which mostly are found in the capital. For second homes, typical situated in the coastal areas, the increase was 18.9% These rates of increase are somehow larger than for houses[2].

2b. Three house price cycles

The last 30 years have experienced three house price cycles as depicted in Figure 1. The house price rise is measured at Statistic Denmark's quarterly indices for single family houses, which is based on the change in the ratio: selling price/publicly assessed property value for the sold house (see 2c below). The implicit price index for private consumption has been used for deflation.

House prices dropped after the first oil crises in 1973 but after a while house prices seemed to have restored and followed a creeping real increase path until 1979.[3] Since the real house prices followed two waves with a drop of around 1/3 from top to bottom and then a return to the former level as shown in Figure 1. The first wave began in 1979, after the second oil crisis and did not result in large drops in nominal prices. After again having reached a maximum in 1986, real house prices dropped 33% and nominal house prices 20% until 1993. Both crises were accompanied by high numbers of foreclosures, annually corresponding to around 1/6 of the turnovers of properties.

In 1993, house prices turned around and began a steep rise during the next years and have been increasing ever since. In the first half of 2004 house prices were 122% higher than in the first half

[2] As the prices for single family houses in average are lower than the prices for owner-occupied flats and summer houses is a curiosity, primarily explained by the location differences.
[3] Unfortunately the used concept for the selling price in the sale document did not follow a pure market concept. The registered prices were highly influenced by the used type of mortgage. Therefore the done reservations on the existence of a real price rise. Without doubt, the turn around in the prices appeared with the second oil crises in 1979.

of 1993. The general inflation, measured by the consumer price index, was 26% in the same period, why the real house price rise for the 11 years was 76%. For owner-occupied flats, the real price rise was 128% for the 11 years.

Figure 1.
Cycles in real house prices. 1975-2004.

Source: Statistics Denmark, quarterly house price indices, deflated with the implicit price index for private consumption – Estimated by stud.polit. Henrik Pedersen.

2c. Different house price indices and statistics

The importance of the price development for properties motivates to include the statistical limitations in the used house price indices. In official Danish statistics, four possible estimations of the single family house price changes exist as presented in Table 3. Three of the indices existed before 1970, but are only after 1980 a precise measure (see footnote [3]). The Association of Mortgage Banks' price statistic has been made from 1995 on. The house prices above and in Table 3 are for the whole country, but are also published for the different regions and after degree of urbanisation.

Different results for the house price rise in accordance with the four indices are seen in Table 3. Fortunately, the signs, the level and the direction of changes are fairly similar. It is the different conceptual content that lead to the different results. The registrations and calculations at producing the indices are seen as fully reliable in accordance with the Danish tradition in producing statistics.

Some few comments to the single price indices are given in Box A. In general, changes in the quality of the sold properties – here single family houses – influence the measured price changes.

Table 3.
Annual increase in single family house prices, different house price statistics. Per cent. 2000-2004.

	Told og Skat[1)] Price indices.	the Association of Mortgage Banks' m^2-prices.	Statistics Denmark Price indices.	Statistics Denmark Average buying prices[2)]
2000 1st h – 2001 1st h	9.0			
2000q2- 2001q2		7.8	6.5	5.8
2000 2nd h – 2001 2nd h	5.8			
2000q4 – 2001q4		6.7	3.6	0.6
2001 1st h – 2002 1st h	2.7			
2001q2 – 2002q2		3.6	3.9	2.3
2001 2nd h – 2002 2nd h	4.5			
2001q4 – 2002q4		2.4	4.2	4.3
2002 1st h – 2003 1st h	4.5			
2002q2 – 2003q2		4.0	2.9	3.5
2002 2nd h – 2003 2nd h	5.2			
2002q4 – 2003q4		5.3	3.4	6.9
2003 1st h – 2004 1st h	9.4			
2003q2 – 2004q2		6.1	7.3	11.0
2003q4 – 2004q4		9.2		

Source: Told og Skat (2004). Danmarks Statistik, Statistiske Efterretninger, various numbers. www.Realkreditraadet.dk
[1)] Told og skat publish as an index with 2001 1.half year = 100 which result in an uncertainty as the first place can be incorrect.
[2)] Average buying prices are also published by Told og Skat.

Box A. Property price statistics.

The Association of Mortgage Banks' price statistic on m^2-price is published first and therefore attract much attention in the public. The statistic rely on the 80-90% of the sold houses, who are re-mortgaged and/or a new mortgage has been raised. This statistic starts 1995. The statistic's m^2-price is equal to the price of the house divided with the size of the house (m^2). Obvious the m^2-price is influenced by changes in the quality of the sold houses. A property price development, estimated by the m^2-prices will include quality improvements or reductions as price changes.

Statistic Denmark's and Told og Skat's[1)] property price statistics contain all free sales, i.e. sales among family members etc. are not included. The basic property sales materials are identical, but some screenings and adjustments of data and at the presentations give differences in the results. Both present price indices and average buying prises.

The average buying prices are similar to the m2-prices influenced by changes in quality over time and by quality differences among the sold houses. Moreover the size of the sold houses influence the average prices.

Statistic Denmark's and Told og Skat's property price indices are calculated by the sold houses' buying price/publicly assessed property value ratios. The change in the sold houses' ratios over a period is seen as an estimate of the price development. The use of the ratio is due to qualitative characteristics as the property's location, age, building technique, size, number of bathrooms etc. influence both the numerator (buying price) and the denominator (publicly assessed property value) in the ratio. Yet still, improvements, maintenance and other qualitative characteristics can influence these indices.

The repeat sales method to express the house price development is not used in Denmark.

[1)] Statistics Denmark has as the only one the responsibility for producing public statistics, while Told og Skat makes the public assessments of properties (see Box B) by using the property price data.

3. The expectation environment – some unscientific observations

Expectations are difficult to give a precise modelling, not least expectations on the house prices' future path. In models – as seen below – often the changes one and more periods back are seen as the best guess on the expectations for the future. Moreover, the real expectations, as you meet them in your everyday life, can change rather quick and often be without any close connection to reality. However, when the rate of house price increase accelerate and still a high and increasing rate is expected, a "bubble" could be under formation.

A couple of everyday house price rise expectations have to be presented: Queuing for the flight he told loudly how excellent his investment in the city flat had been. A professional estate manager expected his new bought flat in the urban renewed, trendy city area (still with some "red lights") could not drop in price. The young couple became married and went abroad, but they kept his little flat and rented it out to capture the capital gain. The friends did sympathize with the student in his rather subsidised private co-operative housing flat, because he did not receive any capital gains. The Norwegian student had bought an owner-occupied flat in Copenhagen and sold it at the double price, when he had to return after 5 years completed study. (He did not know flat prices in Oslo had increased even more in between).

Seen it all before, has to see it once again. Expectations which have to explode. The media do not create the expectations, but often they intensify them a lot. Human beings and media forget. New generations take over as first-time buyers and know nothing about the latest "housing market failure", where they were young or just kids. The financial centres are reorganised with new leaders.

Robert Shiller told a Danish weekly journal (Mandag Morgen, March 14th 2005): *"We go through irrational house price rises in these years. … My experience is that the circumstances are the same in Denmark – as in many other countries. Over optimism and incautiousness are the classic signs of a bubble"*. Long ago, people and journalists have concluded that the housing bubble is a reality. Actually, half of the students, who wish to make a thesis in housing economics, want to write on "the bubble in the house prices".

Fundamentals – and not least the falling interest rates – can explain the increase in the Danish house prices until now (Pedersen, 2004). But obviously the common expectation in the capital and other parts of the country with steep rising house prices is that "if we don't buy now, the prices will increase a lot more and we can never enter the house market". In fact expected user costs are negative and this condition can not last for a long time. Capital gains receiving owners withdraw their equity and invest in summer cottages or expensive owner- occupied flats for their studying children. Despite the steep house price rises, the leverage among the owner-occupiers are maintained as their net liability/housing wealth ratios have been stable, see (Lunde, 2005b). A housing bubble may have started in certain areas of the country and especially on the markets for summer cottages and owner-occupied flats.

Autocorrelation has been found in the Danish house prices (Englund & Ionnaides, 1997) why the best guess seems to be that to morrow's house price rise is the same as to day. However autocorrelation also imply prices will make a turn after some time.

Obviously, the myth that house and flat prices will continue to increase more than consumer prices, will end. Such expectations on steep rising house prices will be capitalised. Owners defer the sale in order to get an even larger capital gain. But when the owner-occupiers start to realise capital gain,

the supply of properties for sale increase, the for sale periods are extended, and the prices begin to decline. Realised user cost will turn around and be positive – and perhaps rather high because of dropping house prices. Already by the reactions at the housing market itself a ”bubble” can be punctured. A shock, a sudden interest rate increase or an economic draw back can do it, too.

4. Housing wealth/income ratios for the owner-occupier families[4]

Of course the percentage change in house, flat and summer cottage prices is equal to the percentage change in the value of the owner-occupied dwelling, if the sold houses are representative for the stock of housing. A change in relative house prices, for example, when the house prices in the capital has increased more than in the smaller provincial towns, seem to result in a redistribution inside the group of owner-occupiers. However – as mentioned - the owner-occupiers had at the same captured an increased liability, as the owners' net present values of the future user costs have increased similarly. The changes in the level as well as in the distribution of housing wealth compared to the owner-occupiers income is of analytic relevance.

At comparing the value of the single family's owner-occupied dwellings – their housing wealth – with the family's gross income is found, how the price changes for owner-occupied houses had influenced the wealth structure and distribution among the owner-occupiers. The family's housing wealth may comprise more than one dwelling, for example, both a house and a summer cottage. These housing wealth/income ratios are presented for the years 1987-2002 in Table 4 below.

At estimating all the owner-occupied dwellings' value, the prices for sold houses must be used, see Box B. The publicly assessed property values are used as proxies for the market values of the properties, even though the market values are systematically underestimated, on average by around 10%, which is more or less equal to the transaction costs of selling the house or flat. Also, there is significant variance between assessed prices and market prices. (Lunde, 2005b). This insecurity has been unchanged over the years.

Box B. The publicly assessment of the properties in Denmark.

- All properties are assessed by Told og Skat (with some obvious exceptions). Before 2003 at January 1. From 2003 at October 1. every second year.
- Primarily, the publicly assessed property value serve a tax proceed purpose. All property owners pay a land tax proportional to the assessed land value and all owner-occupiers pay a property value tax proportional to the assessed property value.
- As a secondary purpose the publicly assessed property value is used at (legal) wealth estimations.
- The assessments must be done in market values, independent of the actual mortgage financing.
- The assessments are based on a complete knowledge about the prices on sold houses, (the sale prices must be reported to the tax authority) .
- The reported prices are used statistically to determine the market prices variation after a lot of characteristics. This data base is used at the assessments (at multiple regression analysis).
- The assessed value of the single property does not depend on its latest sale price.
- For each property, the assessed value of the land, building and whole property is announced.
- For each property, the publicly assessed property value is published (at the web) at the address.
- For single family houses the land value and building value are assessed separately. For each house is determined a weighted floor area, where the weight is 100% for the ground floor and, for example, 80% for the 1. floor, 30% for the cellar, 10% for the garage. Then the basis is the m^2-price for a defined standard house in the local area with an addition /reduction in accordance with

[4] This section is based on a not yet published study by Lunde (2005a).

characteristics as size, age, number of bathrooms, number of toilets, special construction materials, type of roof, heating system etc.

The tax statistics data on Danish owner-occupier families rely on the tax authorities' assessments of these families.[5] The data contain a random sample of 1/30 or approximately 45,000 owner-occupier families within each of the specific years. The numbers ensure that the reliability of the results is high. The incomes on which the ratios are based, are gross incomes and are defined in accordance with the Danish tax rules as the sum of "personal income" and "positive net capital income".

In Table 4, the housing wealth/income ratios for all owner-occupiers, excluding the self-employed, are presented for 1987-2002. For each year the owner-occupiers are divided into deciles according to the size of their housing wealth/income ratio. The decile values mentioned cover the upper limit for the deciles. For example, for 2002, the value 299 in the 6th decile expresses that 60% of all owner-occupiers had a ratio of 299 or below, while the housing wealth of 40% was at a value above 299% of the family's gross income. It should be noted that the median value for 2002 expresses that the owner-occupiers own a house or flat with a value of 2½ times their gross income. The median value can be assumed to be close to the average value.

Table 4.
All owner-occupiers (excluding the self-employed) divided into deciles by size of housing wealth as a per cent of gross income. 1987-2002.

Year	1st decile	2nd decile	3rd decile	4th decile	5th decile	6th decile	7th decile	8th decile	9th decile	10th decile
1987	108	140	163	187	212	245	291	375	565	> 565
1988	98	125	145	165	187	216	259	337	499	> 499
1989	100	128	148	168	191	219	261	333	487	> 487
1990	95	119	138	156	176	202	242	308	444	> 444
1991	86	108	124	141	160	184	221	282	413	> 413
1992	89	111	129	147	166	193	231	298	436	> 436
1993	88	110	128	146	166	191	227	288	418	> 418
1994	87	110	128	146	165	190	224	278	373	> 373
1995	89	113	132	150	170	195	228	280	380	> 380
1996	98	126	147	168	191	218	257	316	426	> 426
1997	103	132	156	178	203	233	275	341	468	> 468
1998	107	139	164	188	214	245	289	360	496	> 496
1999	117	151	178	203	230	264	309	385	531	> 531
2000	127	161	189	216	245	282	333	416	579	> 579
2001	128	164	194	222	252	291	343	428	589	> 589
2002	130	168	197	226	258	299	354	443	622	> 622

Note: The housing wealth to income ratio is calculated as the value of all properties owned by the owner-occupier family (and used by the owner) as a per cent of the family's gross income (before tax).

As expected, the changes in real prices for the owner-occupied houses and flats sold are mirrored through the years in the housing wealth/income ratios for all owner-occupiers in Table 4. The median value for the housing wealth/income ratios dropped from 212 in 1987 to 160 in 1991 and beginning from a value of 165 in 1994, rose steeply to 258 in 2002.

[5] The data for the study have been made available for this study by "Lovmodelsekretariatet" of the Danish Ministry of Finance, formerly in the Ministry of Economics. I am very grateful for the personal support I have met with from Martin Ulrik Jensen, who has provided me with the statistics.

As shown in Figure 1, real house prices reached a maximum in 1986 and the housing wealth /income ratios must also have been at a maximum, as real house prices decreased 11% from the first half of 1986 until January 1, 1987, the median value of the housing wealth/income ratio for 1986 would have been around 238.

In 2002 the housing wealth/income ratios had approached an all-time high. In subsequent years, from 2002q1 to 2004q4, Danish house prices increased by 23% and owner-occupied flats by 28% (Realkreditrådet, 2005). This increase is far above the consumer price rises and any income increase. Therefore, the 2002 all-time high must have been outmatched by the beginning of 2005.

Obviously a part of the difference in the single year's deciles might be explained by age determined differences. However, the housing wealth/income ratios do not vary to any substantial degree among the age groups of owner-occupiers below 50 years of age. In 2002 the distribution by housing wealth/income ratio within the age groups was almost identical for owner-occupiers in the three youngest age groups. Only in the age above 50 years, the ratios begin to increase incrementally with age.

The knowledge of the ratios for the families between 30-39 years of age tells for 2002 the median value of the housing wealth/income ratio was 218, i.e. new owner-occupiers on average bought their house or a flat at a price a little above 2 times the family's gross income or about 2½ times their income if the effect of the publicly assessed property value's underestimation of market values is removed. Also 80% of the owners in this age group had a ratio between 153 and 379. Therefore has to be concluded that families at entering the owner-occupied house and flat markets determine to fix very different part of their income for housing consumption.

5. How the changes in house prices are explained?

The demand for and supply of housing services contribute to determine the prices on properties and by this the prices on owner-occupied houses and flats in a market economy. Also in Denmark, the house prices have been through many careful analysis, latest by Pedersen (2004). The housing market is an important part of the macro economy, with an interactive influence. In the long run the "fundamental" factors – first of all the real disposable income after tax – have an evident influence.

The central bank manages a macro economic model, MONA, to give an interpret the economic development and to prognostic purposes. The model contain a housing market block with two behavioural relations – one for house prices and one for residential investments. The house-price relation can only include the prices for owner-occupied houses and flats. (Danmarks Nationalbank, 2003b). The house-price relation has been re-estimated for use in this paper, cf. Box C. The result of this estimation is compared with the results of former estimations in Table 5.

The housing market model in MONA also contains a residential-investment relation, where the house price/constructions costs (Tobin's q) together with income and capital costs are driving the residential investments. This part of the model has not been discussed here.

In the model's house-price relation, the house price changes are determined by the short term effects: changes in the inflation (consumer prices), changes in user cost and in the one period lagged user cost, and by the long-term effects: the absolute user cost level, the real house prices, the

inflation expectations, the house price inflation expectations and the real disposable income/housing quantity.

"Specifically, the coefficients for all terms with price changes are restricted, so a lift of the price increase by 1 percentage point per annum in the long term will raise house prices by the same factor as a fall by 1 percentage point in the interest rates after tax," (Danmarks Nationalbank, 2003, p. 45). In the long-term relation income elasticity is 1, and the own-price elasticity is negative.

Owner-occupiers' user cost contain in principle a nominal, risk-adjusted interest rate after tax, depreciations, property and land taxes, operational and maintenance costs – and a deduction for capital gains. In MONA is used a less restricted approach: nominal interest rate after tax, a tax element and a depreciation rate. This user cost concept is close to the owner-occupier's cash flow or housing expenditures (exclusive instalments on loans plus operational and maintenance costs). However, the expected rate of inflation is included to approach a correct user cost in the model.

In all, the interest rate has a strong influence on the house prices in the model. The negative correlation between the real house price and mortgage bond interest rate after tax is clear, why the ongoing interest rate drops had been driving the property prices – especially on houses and flats. The adaptation is relatively quick at interest rate chances.

"House prices not only influence housing construction, they are also included in the consumption relation's housing wealth and affect private consumption. This means that interest rates primarily impact on private consumption via the housing market, which is a further reason to examine the housing market." (Danmarks Nationalbank, 2003b, p. 42).

Box C. Estimated housing demand relation – the house price equation for 1974q2 to 2004q3.[1)]

Variable in the demand relation / house-price relation:

kp: house prices
pcp: private consumption, implicit price deflator
interest: nominal mortgage interest rate after tax, weighted average mortgage rate; through some linear restrictions (in the programming) is found a long term real interest relation
trate: tax on owner-occupied dwellings, estimated rate as used for user cost
dkpe: expected increase in house prices
dpcpe: expected increase in the implicit price deflator for private consumption (inflation)
ydp: disposable income
ipv: depreciations (private)
fwh: Housing quantity, bn. 1995-DKK.
Estimated depreciation rate 0.01.

Estimated equation for the housing demand / house prices:

KP, Restricted Ordinary Least Squares, quarterly data for 122 periods from 1974q2 to 2004q3.

house price **consumer price deflator** **user cost** **user cost$_{-1}$**

dlog(kp) = -0.01432*dlog(pcp) -3.76038*diff(interest+trate+0.01) -0.87149*diff(interest+trate+0.01)[-1]

(t=0.07716) (t=9.37594) (t=2.09026)

user cost **expected house price change**

- 0.66649 * (interest.1+trate.1+0.01) + 0.07501 * dkpe[-1]

(t=2.36957) (t=1.69191)

expected inflation **real house price**

+ 0.84506 * dpcpe[-1] - 0.03372 * log(kp.1/pcp.1)

(t=2.74949) (t=2.55920)

real disposable income / housing quantity **constant**

+ 0.09634 * (log((ydp.1-ipv.1)/pcp.1)-log(fwh.1)) + 0.07937

(t=3.31878) (t=4.58663)

Sum Sq 0.0300 Std Err 0.0162 LHS Mean 0.0149
R Sq 0.6331 R Bar Sq 0.6106 F 7,114 28.1062
D.W.(1) 1.6412 D.W.(4) 1.8225

Expectations are included in the model, as expected house price increases and as expected inflation. However, in reality, such expectations should have been capitalised as higher house prices. The expectations are formed as changes in the lagged price variable, i.e. a house price rise in the last period (or before) results in increasing house prices in the next period; the expectations are looking backwards. Otherwise, simply the house price increase depends on the former increase in house prices and in general inflation.

The three first explanatory variables are changes and result in the short term elasticises. The rest of the explanatory variables are the long term elasticises.
DW is close at 2 and the model does not contain any important autocorrelation.
The model's ability to explain the house price development is accepted as $R^2 = 63\%$. The most variable are significant as the t-values are above 2; especially both at the short and the long term are the user costs significant. The coefficients have the expected signs. As the coefficient to user cost is negative, an interest rate rise – and by this an user costs increase – will result in a house price drop.

[1)] *Stud. polit. Henrik Pedersen made the regressions.*

The results from three different estimations of the house-price relation are compared in Table 5. Characteristically, the results are similar even though the estimations cover different periods and also contain other substantial differences. In the first model an average bond rate is used[6]. (Nationalbanken, 2003, p. 223). In the other estimation is applied: *"a long-term mortgage rate up to 1996, and a weighted average of the Association of Danish Mortgage Banks' series for long- and short-term mortgage rates, respectively, from 1997 onwards. The weight of the short-term rate is calculated as the percentage of adjustable-rate loans in new lending by mortgage-credit institutes,"* (Pedersen, 2004, p. 33). The average bond rate from the model's data bank is used in this paper.

Through user costs the changes in the interest rates and in the taxation of owner-occupied dwellings have a strong influence on the house prices in all three cases. A permanent drop in the interest rate *after tax* at 1 percentage point will increase the house price with 8% in the report on MONA (Danmarks Nationalbank, 2003, p 44), with 9.4% at Pedersen (2004) and with 19.8% in this paper.

[6] As the average rate is not defined, a qualified guess is the central bank's ordinary published average rate for all the bonds at the Danish market is used.

For the different periods the explanatory power of the estimated house-price relations could vary somehow. Especially the result of the last relation could indicate a lower credibility. On the other hand, the inclusion of the years from 1999 on in the regression could catch a certain degree of herd behaviour in the expectations to be explained by the continuing interest rates drops and steep house price rises. Moreover the interest rates drops after 1997 and 1999, the last years in the two first regressions, imply that an interest rate drop at 1 percentage point must lead to an even stronger rate of increase in the house prices.

Table 5.
Three different versions of the house price equation.

Variable	name	**MONA 1974q2-1997q4 coefficient**	**t-value**	**Pedersen (2004) 1974q2-1999q4 coefficient**	**t-value**	**This paper 1974q2-2004q3 coefficient**	**t-value**
House price	**dlog(kp)**						
Consumer price deflator	dlog(pcp)	0.3074	1.4	0.2531	1.3	-0.0143	0.1
User cost change	diff(interest + trate)	-3.7811	8.7	-3.7589	9.0	-3.7604	9.4
Lagged user costs change	diff(interest$_{-1}$ + trate$_{-1}$)	-0.7791	1.7	-0.7370	1.7	-0.8715	2.1
User costs	interest$_{-1}$ + trate$_{-1}$ +0.01	-0.7927	2.5	-0.8505	2.8	-0.6665	2.4
Exp. change in consumer price deflator	dpcpe$_{-1}$	0.7709	2.2	0.8666	2.5	0.8451	2.7
Exp. house price change	dkpe$_{-1}$	0.1949	2.9	0.1706	2.7	0.0750	1.7
Real house price	log (kp$_{-1}$/pcp$_{-1}$)	-0.1026	3.8	-0.0907	3.6	-0.0337	2.6
Real income/ housing quantity	log((ydp$_{-1}$ – ipv$_{-1}$)/pcp$_{-1}$) – log(fwh$_{-1}$)	0.0554	2.0	0.0569	2.1	0.0963	3.3
Constant		0.0663	3.5	0.0706	3.9	0.0794	4.6
R^2 =		0.6920		0.6767		0.6331	

6. Determining owner-occupation: user costs or in reality interest and tax payments

The regressions above showed that the changes in the interest rates and tax rates had a decisive influence on the house prices. In a broader perspective, the more detailed financial and taxation conditions might have a similar impact but difficult to model.

Moreover, at stepwise estimations of the house price equation has been found that the coefficient on the short term user cost has been rather constant through time at values between -3.6 and -3.7, see Table 6. These estimations have been carried through step by step, beginning with the 67 periods from 1974q2 to 1990q4, then the 71 periods from 1974q2 to 1991q4, then… , and at last the 122 periods from 1974q2 to 2004q3.

Table 6.
Value of the coefficient on the short term user cost.

1990q4	1991q4	1992q4	1993q4	1994q4	1995q4	1996q4	1997q4
-3,58781	-3,5988	-3,67926	-3,65043	-3,74437	-3,72309	-3,74463	-3,75026
	1998q4	1999q4	2000q4	2001q4	2002q4	2003q4	2004q3
	-3,76379	-3,76498	-3,74073	-3,73528	-3,735	-3,71074	-3,76038

Source: Regressions by stud. polit. Henrik Pedersen.

In a financial calculation the minimum price for houses and flats on market conditions would depend on the interest rates and taxes too. Here, the market price of the property is equal to (or above) the net present value of the net housing services, where the taxes (together with operation and maintenance costs) are deducted in the value of the gross housing services and where the risk adjusted interest rate after tax is used for the discounting.

As underlined in the report, in reality MONA's user cost concept only contains the nominal interest rates plus tax element (Danmarks Nationalbank, 2003b, p. 44). The nominal interest rate is the average bond rate as mentioned. The tax element could include land tax and the tax on imputed rent and from 2000 on of the property value for owner-occupied dwellings.[7]

The "user cost" in the model is conceptually close at the net housing expenditure as used in the real estate agents' sale documents. The most important difference is that instalments are included in this expenditure but not in MONA's user cost. Also other less important elements are included in the sale documents. In reality this user cost is not a cost concept but partly a liquidity concept.

Besides the common opinion among the real estate agents is that the family's decisions about buying of a home rely on the amount, the buyers can pay out of the monthly income, i.e. on the liquidity and by this on the net housing expenditure in the sale documents. The agents also argue that user costs or similar more precise cost reflections are of no importance for the decision.

The market knowledge as well as the estimated house-price relations indicate that the buyers decision platform include debt services on loans at around 95% of the sale price plus taxes and few other non-voluntary expenses. Obviously operational and maintenance expenditures as well as the risk at the investment are not weighted high, perhaps as the size of these expenditures is unknown. In this way the owner-occupiers' taxes, interest expenses and other loan conditions are of high importance for the owner-occupation market. Below the changes in these conditions are given a special attention.

Traditional the economic-policy for the market for owner-occupation in Denmark is directly or indirectly governed through taxation and mortgage conditions. The interest rates are determined at the capital market and only the short interest rate is an instrument in the monetary policy.[8] Only few restrictions on mortgage banks and loans remain in force. The commercial and mortgage banks have made loan innovations the last years and have restricted their products in other cases.

If true that the owner-occupiers decide to buy at the cash flow, the debt services and by this the interest rate for the type of mortgages, they prefer, determine the demand decision, not the theoretical correct risk adjusted interest rate.

[7] The content of the "tax element" is defined as "*Tax on one-family houses and freehold flats, tax rate for user cost*" in the variable list (Danmarks Nationalbank, 2003b).

[8] At the first page in a book on Danish monetary policy, Danmarks Nationalbank described the bank's single policy target: "Denmark maintains a fixed-exchange-rate policy vis-à-vis the euro. This means that the objective of monetary and foreign-exchange policy is to keep the krone stable against the euro. Other aspects than the exchange rate – e.g. cyclical developments in Denmark – are not considered in relation to monetary policy." (Danmarks Nationalbank, 2003a).

Traditionally, mortgages were financed by selling fixed interest rate bond with 20 or 30 years term. Adjustable-rate mortgages were introduced in 1996 and approached already in 1999-2000 a larger market share. Since – in general – a ”normal” yield curve has ensured the interest rates on the 1 year mortgage bonds, sold to refinance the 30 years mortgage loans, have been much lower than on 30 years fixed interest bonds. Irregularly, adjustable-rate mortgage are seen as ”inexpensive” mortgages. At the end of February 2005 46% of the owner-occupiers' mortgages had an interest adjustment facility, (Danmarks Nationalbank, 2005). From October 1. 2003 the parliament accepted interest-only mortgages could be offered to owner-occupiers. Already the market share for this loan type is 20% for the owner-occupiers' mortgages, nearly all with adjustable-interest rate.

Remarkably, the mortgage and commercial banks and the real estate agents claim in common that they only accept to lend to house buyers, who are able to pay the higher debt services at fixed interest mortgages. However, this does not prevent the buying family to decide on the (lower) debt service for other loan types, if they want to buy and how expensive a house they want to buy.

The central bank announced: *”In the future the relation should presumably be estimated on the basis of a lower average interest rate considering the short-term mortgage loans.”* (Danmarks Nationalbank, 2003b, p. 46). In fact Pedersen (2004) included the interest rates on the short-term mortgages at his estimation. Another aspect is that the new interest-adjusted mortgages might have pushed the house price rise upwards. Pedersen estimated this increase to 4%. However the effect of this innovation – as well as of new products later on (see Section 8) could be higher, even though the new products are offered at market conditions and, therefore, are not “inexpensive” loans for the debtors. However, the remaining question is: when the owner-occupiers' focus on liquidity create a house price rise, do this express the effect of a “fundamental” or an element of a “bubble”?

7. Taxation of owner-occupied dwellings, tax reforms and, possibly, subsidiation of owner-occupation

In the personal income taxation the tax rates for positive net interest incomes are in the range 33 to 59%, depending on the size of total personal income. The tax rate for deducted net interest expenditures is always 33% (in the average municipality). The right to deduct interest expenditures does not depend on the loan purpose or type. Besides, the tax rate is 15% at the yields of non-liquid, institutional saving.

Owner-occupiers' imputed rent was taxed from 1903 to 1999. Then the imputed rent tax was replaced by a property value tax at 1% of the publicly assessed property value. The detailed rules are seen in Box D. Except in rare cases, owner-occupiers are not taxed by their capital gains on the housing wealth.

Box D. Property value tax – owner-occupation. (100 euro = 765 DKK)

Basic rule: 1% of the publicly assessed property value at the latest public assessesment, of property value up to 3040,000 DKK

- 3% of the publicly assessed property value above 3040,000 DKK
- Reduction at 0.2%, when the house or flat was bought 1.7.1998 or earlier
- Reduction at 0.4%, maximum 1,200 DKK, when the house or flat was bought 1.7.1998 or earlier
- Reduction at 0.4%, maximum 6,000 DKK for owners at 67 years of age or above. At incomes over 235,800 (couples, 2004), the reduction is totally phased out with increasing income
- Two set of limitation rules on the annual increase in the property value tax, one for pensioners and one for other owner-occupiers

"Tax stop" since 2002:
The property value tax might be calculated at the lowest of the following values:
The publicly assessed property value for 2001 + 5%
The publicly assessed property value for 2002
The latest publicly assessed property value

Land tax is imposed on all residential and commercial properties. The tax is calculated by the publicly assessed land value with a rate, which is determined by the local municipality. In average for all properties, the land tax proceed is equal to 0.55% of the publicly assessed property value. By this information the land tax proceed on owner-occupied properties can be estimated to a little more than half the proceed of the property value tax.

The property value tax and before the tax on imputed rent has always been under political discussion. The proceed of these taxes had varied with the changing prices for owner-occupied dwellings, from 0.5 to 1% of GDP as seen in Table 7. The remarkable drop from 1993 to 1994 is due to the reduction of the imputed rent rate from 2.5 to 2.0% of the property value, a part of the 1993 tax reform.

Table 7.
Proceed of imputed rent taxation or of property value tax in per cent of GDP. 1982-2005.

Year	Proceed as per cent of GDP	Year	Proceed as per cent of GDP	Year	Proceed as per cent of GDP
1982	0.67	1990	0.86	1998	0.57
1983	0.68	1991	0.78	1999	0.57
1984	0.76	1992	0.82	2000	0.66
1985	0.98	1993	0.81	2001	0.72
1986	1.05	1994	0.56	2002	0.75
1987	1.06	1995	0.56	2003*	0.74
1988	1.02	1996	0.56	2004*	0.73
1989	0.90	1997	0.56	2005*	0.71

* Estimate
Source: Ministry of Taxation, web page. http://www.skat.dk/tal_statistik/skatter_og_afgifter/2869.html?rel

Of course, the taxes on owner-occupied dwellings and the tax rate for nominal interest expenditures (on debt and on equity) are deducted in the user costs for owner-occupiers. Similar, these tax rules' influence on the housing expenditure for owner-occupied dwellings are included as mentioned.

By this the discussion is not, if a tightening of these tax rules has a negative influence on the prices for owner-occupied dwellings, but on the tightening works trough the housing expenditures as in MONA or – theoretical more acceptable – through user costs and through the net present value of the owner-occupiers' housing services as an estimate of the property price.

Denmark has had three tax reforms with effect from 1987, 1994 and 1999[9]. At all three tax reforms, the tax rate for the deduction of the interest expenditures has been lowered and the housing expenses for buyers and other owner-occupiers has been increased. Only the most important changes with influence on owner-occupation has to be mentioned here[10]:

[9] Determined by the parliament in 1985, 1993 and 1998.
[10] The tax reforms and especially the "Whitsun" package from 1998 are described and analysed in Lunde (1999). The official presentation of the "Whitsun" package was done in a publication by the government (Regeringen 1998).

a) In 1987 the tax rates for positive and negative capital income were lowered to 50% from between 50 og 73% previously, depending of the income. The imputed rent was seen as a positive capital income, why the tax of the imputed rent was lowered too.
b) In 1994 the tax rate for negative capital income was lowered from 52.2%[11] to 44.4%. Still, the imputed rent could be deducted in the interest expenditures and got a lower tax value by this. Also, the rate for the imputed rent (before tax) was reduced to 2.0%.
c) At the "Whitsun" package in 1998, the tax rate at deducting interest expenditures was reduced from 46.4% to 32.4% from 1999. And the imputed rent taxation was transformed and slightly tightened as the property value tax.

In all, the "Whitsun" package was the strongest of these tax reforms in regard to the effect on the owner-occupiers' housing expenditures and user costs. When the house buyer should have the same housing expenditures after the "Whitsun" package as before, the compensating house price drop should have been 15% and at unchanged user costs 20% (Lunde, 1999). The government expected, house prices would increase up to 14% less than without the package (Regeringen, 1998).

Owner-occupied dwellings – and other properties are an immobile tax source. This fact has tempted to many proposals on a higher taxation on owner-occupation. In spite of housing consumption only occupy a limited part of the income, such a redistribution of the tax burden would only lead to a minor reduction of the income taxation. Estimated for 1999, a removal of the right to deduct interest expenditures and an increase in property value tax for owner-occupied from 1 to 6%, only 11.6% of the total taxation would have been redistributed, (Lunde, 2001).

To implement a higher taxation of owner-occupation could be motivated by the owner-occupied dwellings were especially subsidised. Formerly correct, but at the actual tax structure the argument is more questionable.[12] Still, obviously, the property value tax is lower, when a family invest in an owner-occupied dwelling, than at private investments in rental residential properties. If instead the family's alternative is to invest in a commercial firm, also through a company, or to invest in bonds and shares, the owner-occupied dwelling is taxed less. However in contrast, private co-operative associations and social housing associations – and the associations' funds - are exempted from paying income tax and of any property value tax. And the households' dominating saving alternative is institutional pension saving, where the yields only are taxed by 15%, a flat rate tax at a similar level as the property value tax. It seems impossible to decide whether owner-occupied dwellings are subsidised. An estimation, based on "true" imputed rents of 6% or 8% and on tax rates at 15% and 59% resulted in an annual "property value tax subsidy" in the range –0.1% to +3.7% (Lunde, 2004).

8. Financial deregulation and mortgage innovations

The old mortgage system in Denmark, where the mortgage loans are funding by selling bonds at the capital market, is relatively unique in an international comparison. The system will not be described here as actually already done (Lunde, 2003; Mercer Oliver Wyman, 2003; Pannell, 2003; Frankel et. al., 2004).

In stead, the deregulation of the mortgage system since 1980 and the financial engineering is in focus below. In theory, an improvement of using owner-occupied house and flats as security for loans would be capitalised in higher property prices, as the owner-occupiers can borrow at lower

[11] Because of increasing municipality tax rates, the lowest total rate had increased from 50% in 1987 to 52.2% in 1993.
[12] The many imbalances in the Danish housing and property taxation are analysed by Lunde (2004).

interest rates, but only as an one-off effect. Similar an addition to the range of mortgage products would increase the debtors' options at choosing the "best" mortgage loan, would work against higher property prices, again in theory as an one-off effect.

The owner-occupiers options for raising mortgages were rather restricted in the 1970s, where the lending – especially mortgage for private properties – was closely regulated as in a central planned economy. At the beginning of the 1980s the first deregulation appeared as the buyers of owner-occupied dwellings were allowed to raise a "normal" mortgage finance. In reality, through the 1980s was seen a stop and go policy for raising mortgages to finance owner-occupied dwellings with further restrictions on loan purpose, loan type and term. In the years 1992-93 important modifications for owner-occupiers in raising mortgages were set through. Perhaps most remarkable, now the owners could make an equity withdrawal in mortgage, even though they had bought the dwelling many years ago.

The changes in the interest rates[13] has as shown a large influence on the prices for owner-occupied properties. In the 30 years period, the house price changes have been depicted for in Figure 1 and explained for in Section 5, the importance of the interest rates has been unchanged but the influence has changed in character. In the 1970s inflationary economy the double-digit interest rates contained high inflation expectations and the market for owner-occupation was marked by the front-end loading problem, besides de few options to raise long termed mortgages. In 1982 the new government abandoned the devaluation policy and made a drastic anti inflation, the Danish krone became linked to the German DM. The inflation and the nominal interest rates dropped and the spreads between Danish and German interest rates were reduced gradually. As a consequence the real interest rates increased.

Danish buyers of houses and flats are not facing front-end loading problems any longer, and their liquidity at financing has been relieved, but also more expensive at the increase in real interest rates. Moreover, as discussed in the section above, the tax value of the right to deduct interest expenditures was reduced in 1987.

At the "housing market failure" 1987-1993 the owner-occupiers got a new set of financial problems. Compared with the income their net liability even dropped from 1987 to 1993 (Lunde, 2005b). The commercial as well as the mortgage banks had large losses and deficits, why private customers had difficulties in raising new loans. Looking at falling nominal prices for houses and flats, owner-occupiers with negative equity could not raise new loans in the banks. Perhaps as the most surprising the owner-occupiers' net interest expenditures, compared to their incomes dropped from 1987 and up to 1994 (see Table 9), possibly these changes contributed to stop the "housing market failure".

At the speculation against the Danish (and especially the Swedish) kroner in 1992, the monetary authorities used their "interest weapon". After, through 1993, the interest rates dropped more than 3 percentage points to the lowest level in more than two decades. Moreover, then the deregulation of the mortgage system for owner-occupiers got a strong influence. A wave of profitable prepayments of older, fixed interest rate mortgages were effectuated. Besides, the new government had the power to set an expansionary fiscal policy through. The house market made a quick turn. The whole Danish economy made a quick turn.

[13] The changes in the interest rates can not be illustrated by a single interest rate item and is not presented in this paper. Interest rates can be found in the many publications from Danmarks Nationalbank with time series for interest rates.

The interest rate level has dropped additionally since 1993, though not without interruptions. The financial engineering activity created new types of mortgages. And the deregulation has opened for new loan types. After 200 years' tradition for fixed mortgages, politicians as well as responsible in the financial system argued, that the Danes preferred fixed interest mortgages. Nobody argued that the neighbour countries, Sweden and UK, operated with variable interest rate mortgages. Soon afterwards was seen that the Danish owner-occupiers had another opinion.

Adjustable-rate mortgages were introduced in 1996 and from 1999-2000 on the market share was increasing quickly. The adjustable-rate mortgages have many similarities with AMR-mortgages in US. Mostly adjustable-rate mortgages have a 30 years term, where the interest adjustments are done at beforehand defined dates with the interest rate, which is equivalent to the sold bonds price. The sold short-term bonds have a term on a ½ year, 1 year, 2 years, 3 years, 5 years and up to 10 years. Less common these loans are funded at selling a portfolio of bonds.

As the yield curve has been increasing and the interest rates falling since the introduction of the adjustable-rate mortgage, debtors with these loans have paid significant less than debtors with fixed interest loans. Adjustable-rate mortgages are sold as having "low interest payments" or "inexpensive" loans without regard to neither "inexpensive" nor "expensive" mortgages exist on market conditions. The most debtors overlook that the debt on an adjustable-rate mortgage is close to be unchanged at changes in the relevant market interest rate, while the debt on the offered fixed interest mortgages will drop significantly at an interest rate increase – and only increase a little at an drop in the relevant market interest rate. Apparently these financial mechanism are difficult to understand for the debtors – and for their financial advisors.

From October 1. 2003 it became rendered possible for owner-occupiers to raise interest-only mortgages, with an interest-only period up to 10 years. Most of these loans have an interest-adjustment facility too. The different mortgage types' part of the outstanding mortgages are presented in Table 8 below. Unfortunately, a similar table can not be produced for owner-occupiers only but – using partial information – such a table would have given quite the same relations. The only important difference is that nearly no owner-occupiers have index-linked mortgages.

Table 8.
Outstanding mortgages to Danish debtors after type of loan. Per cent, end of year.

	2003	2004
Ordinary interest-adjustable mortgages	31.0	31.4
Interest-only mortgages with interest- adjusted rate	4.8	13.1
Traditional fixed-interest mortgages	56.3	47.0
Interest-only mortgages with fixed interest rate	0.7	2.5
Index-linked mortgages	7.1	6.4

Source: Danmarks Nationalbank (2005b).

At the end of 2004, the mortgage banks introduced a new loan type, a "guarantee loan", where an interest-adjusted mortgage loan is combined with a cap rate at – actually – 5 or 6% fixed interest rate. Reaching the cap rate, some types continue as fixed interest mortgages, other types continue at the cap rate only until the interest rate drops below the cap rate again. The loan type has been accepted by the borrowers but no statistical information exist until now on this new loan type. However, a new press release tells a significant part of the mortgages – and especially mortgages with interest-adjustment facility – are being re-mortgaged by these "guarantee loans".

The distribution of outstanding mortgages after type was seen in Table 8. However, in some periods a very high part of the new raised mortgages had interest adjustment. Therefore a high part of bought houses and flats must have been financed with adjustable-rate mortgage. This connection implies that the "low" interest rates at the adjustable-rate mortgage instead of the "high" rates on fixed interest rate mortgages have been determining for the buying and therefore for the prices on owner-occupied houses and flats. The marginal buyer might have made the decision at the interest-adjusted mortgages interest rates and other conditions.

Loan type and other financial conditions seem to have had a tremendous influence on the housing expenditures at buying. In the real estate agents' net housing expenditures – at the actual interest rate level and structure – is nearly the half at financing with interest-only mortgages with interest adjustments than with fixed interest mortgages.

Therefore, that the last 5 years re-mortgaging of the owner-occupied houses and flats has resulted in a certain and significant rise in the prices, has been made convincing.

9. Owner-occupiers' net interest expenditures[14]

Statistics on the Danes' debt services do not exist, but their interest incomes and expenditures are registered as a by-product of the taxation. Therefore tax statistic, as above in Section 4 is used.

The falling interest rates must work against reducing interest payments. At a given loan debt and term the owner-occupiers' debt services are reduced. The shift in the debt structure against a slightly higher mortgage part after the financial deregulation in 1992-93 also represented a change to lower interest rates, which reduced the interest payments. Moreover, debt services were lowered by the much longer terms on mortgage than on commercial bank loans. As a third factor, the move in the choice of mortgage type from fixed interest rate loans to adjustable-rate mortgages had reduced interest payments further.

However, the interest rate drops' influence on property value and debt size must be recognized too. Therefore, it can not be taken for granted the interest payments have dropped – even though the interest rate drops.

Owner-occupiers between 30-39 years of age represent most of the intake of new households to owner-occupation. For owner-occupiers in this age group the families' net interest expenditures/income ratios are shown in Table 9. The net interest expenditure is the difference between the gross interest expenditures and the interest incomes. The owner-occupiers have been distributed after size of their income in the single year in the table and inside the single decile, the estimated ratio is an average for the owners in the decile.

[14] The content of Section 9 comes from Lunde (2005b).

Table 9
Average net interest expenditures in per cent of gross income for owner-occupiers (excluding the self-employed) between 30-39 years of age, divided into deciles by size of their income 1987-2002

Income deciles / Year	1st decile	2nd decile	3rd decile	4th decile	5th decile	6th decile	7th decile	8th decile	9th decile	10th decile	All
1987	25	22	21	20	20	20	20	20	20	19	20
1988	26	24	22	20	20	20	19	20	20	18	20
1989	25	21	21	20	19	19	19	19	19	18	19
1990	25	21	20	20	18	18	19	19	19	18	19
1991	24	20	18	19	18	18	18	17	17	18	18
1992	23	19	17	17	17	17	17	16	16	16	17
1993	21	19	17	17	17	16	17	16	16	17	17
1994	18	16	15	15	15	15	16	14	15	13	15
1995	19	16	15	15	15	15	15	15	14	13	15
1996	18	16	15	15	15	15	15	14	14	13	15
1997	18	16	15	16	16	15	15	15	15	13	15
1998	17	15	16	16	15	15	15	14	14	13	15
1999	19	16	15	14	15	14	14	14	13	11	14
2000	18	15	15	14	15	15	14	14	14	11	14
2001	18	15	15	15	15	15	15	14	14	11	14
2002	19	15	15	15	14	14	14	13	12	11	13

Source: Lunde (2005b).

Two general features can be remarked. First, the average net interest expenditure/income ratios drop somehow with increasing income. This relation indicates that housing consumption as part of the owner families' consumption decreases with increasing incomes. Second, the average ratios become lower through the "housing market failure" years in all deciles. After 1993 the net interest expenditure/income ratios have been nearly constant in each decile as a combined result of the falling interest rates, steep rising house and flat prices and large debt increases.

Important for the owner-occupiers' risk exposing and in a financial stability context, the owners between 30-39 years of age had in 1987 a net interest expenditure/income ratio at 20% (median value), i.e. interest payments were occupying a relatively high part of the families' incomes before tax. As the interest could be deducted at a 50% tax rate from 1987 on, the median ratio for the net interest expenditures after tax would have been about 10% of the gross income. However, as the average income tax rate easily could be at 50%, the level for the net interest expenditure/income ratio after tax would be around 20% still. Besides, the owner-occupiers had to include tax on imputed rent, land tax, expenditures for maintenance etc. in their housing expenditures.

These ratios dropped through the years 1987-1993 to a level at 15% (the median value) in 1994 and had been stabilised at that level since. In the lowest 5 income deciles, the ratios have been stable since 1994, while the ratios had dropped a little – up to 2 percentage points – in the 5 deciles with highest incomes. Seen in an after-tax perspective the drop in the net interest expenditure/income ratios are less convincing as the tax rate for deducting interest expenditures have been reduced to 33%. Therefore the after-tax ratio for the median owner-occupier in 2002 must have been around 10% and by this more or less equal to the net interest expenditure/income ratio after tax in 1987.

10. Does house price rises boost private consumption?
The Danish house prices turned in 1993-94 and, first, the high price increase for houses was seen as a positive result of the Danish economic policy. Quickly this picture crackled, because already in 1997 the central bank and The Economic Council expressed that the steep house price rise lead to increases in the private consumption. In accordance with the consumption relation in MONA: *"the consumption in fixed prices will increase with around 10 DKK for each 100 DKK increase in the real wealth."* (Danmarks Nationalbank, 1997b, p. 9). The argument was that the transmission of an increasing housing wealth to the private consumption would happen as easily the increasing equity could be withdrawn through mortgage and ordinary bank loans, because in the years after the minor financial crisis in Denmark 1987-1993 the credit institutions willingness to credit expansion grew quick. Directly, the Economic Council argued for, the measure would be to tighten the taxation of the owner-occupied dwelling, while Bodil Nyboe Andersen, leading director for the central bank, just suggested in the public: *"A higher property taxation would be able to limit the increase in the property prices, …"* (Danmarks Nationalbank, 1997a, p. 52). The arguments were repeated of the Economic Council and the central bank in their publications in 1997 and the beginning 1998, see DØR (1997a; 1997b) and Nationalbanken (1997a; 1997b; 1997c; 1998a; 1998b).

However the macro effect on the private consumption of the increasing house prices was more dubious. The argument was that a clear positive correlation between the house prices and the private consumption was not enough and a theoretical explanation with causal connections was missing. Moreover was seen that the private consumption increased less than GDP in these years.

When an owner-occupier had received a capital gain on his house, he is wealthier. He can realise the capital gain at selling the house and increase his consumption of non-housing goods. Compared over the same period, the house buyer now has to pay a higher price and must reduce his consumption of non-housing goods. When the owner of a house withdraw equity through a new mortgage, the proceed can be used to increase his consumption of non-housing good, while the creditor has to lower his consumption in the same degree. Quite the opposite happens, when the debtor has to lower his consumption with the debt services, while the creditor can increase his consumption into a similar extent. These arguments were presented by Lunde (1998) and had many similarities with Miles' theoretical and empirical analysis (Miles 1994).

The debate in Denmark ended with an article in the central bank's quarterly review, where an economist in the central bank argued that on the long-term the increasing house prices would not influence private consumption, while on the short-term the house price rise could influence the propensity to consume out of income (Pedersen, 1998). This view was in accordance with the earlier critic (Lunde, 1998). But absolutely, "the man in the street" is convinced that the rising house prices boost the owners' economy and that the tenants are impoverished.

Similar, during the inflation economies in the 1970s was discussed on the capital gains on owner-occupied dwellings did increase the private consumption and was driving on a further inflation. Internationally the link between house prices and consumption has received attention from the central banks as well as from research in recent years. As an example Kennedy and Andersen analysed the interaction between the housing market and household saving (and by this consumption) and as they found a diverse response in the analysed OECD countries, they did not reach any clear conclusion (Kennedy & Andersen, 1994). Moreover, they pointed at an important role of expectations in the determination of house prices and on the changes through *"the stance of*

monetary policy, the fiscal treatment of housing and financial deregulation." (Kennedy & Andersen, 1994, p. 51).

Still new analysis appear of the house and flat price changes influence on the private consumption, of the wealth effects on the housing market, of the transmission from the mortgage market to the housing market, etc. Just to remark a couple of important contributions, Case, Quickley and Shiller (201) found a statistically significant and rather large effect of housing wealth upon household consumption and found that housing market wealth has a more important effect on consumption than does financial wealth (Case et. al., 2001). Benjamin et. al. (2004) found a similar result that an additional dollar of real estate wealth increases consumption by 8 cents in the current year, as compared with only 2 cents for financial wealth. Also they conclude that *"Households use their housing and real estate to smooth and stabilize consumption when other assets are performing poorly."*

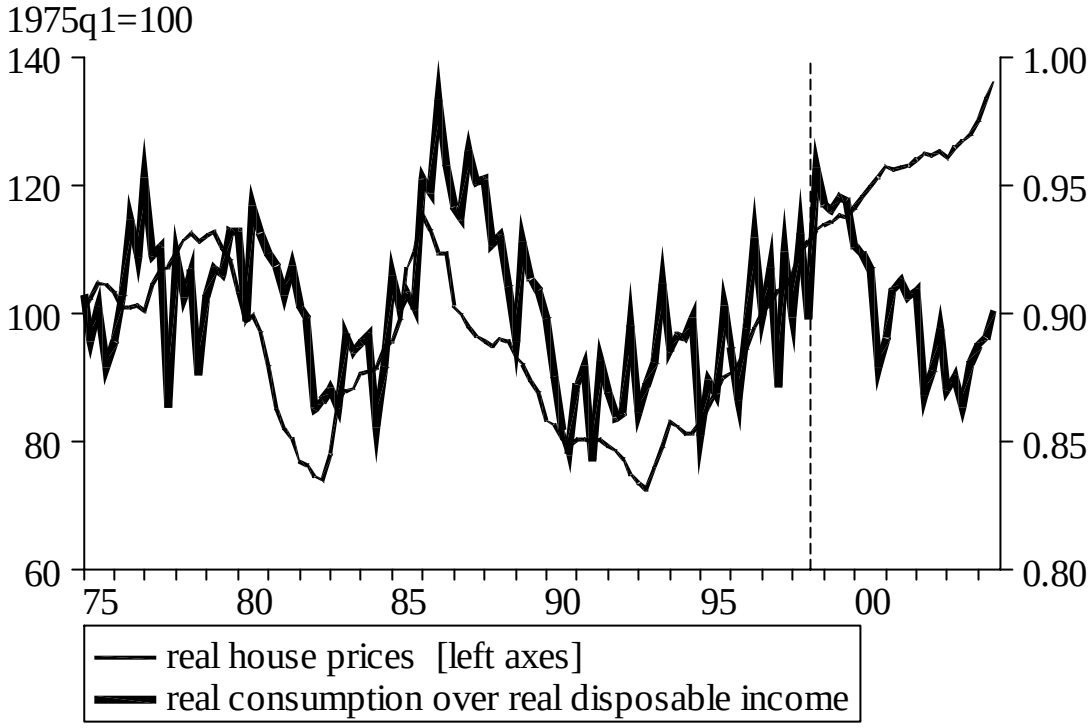
In a sharp contrast, S.-Y. Phang (2004) conclude *"that the dramatic increases in house prices and housing wealth over the past two decades"* with two major housing boom-bust cycles *"had had no significant positive effect on the aggregate consumption in Singapore"*. However, this *"may be attributable to institutional factors: it is not as easy for households to withdraw housing equity to finance consumption."*

The ECB study on structural factors in the housing market identify the house prices' wealth effect on non-housing consumption expenditure and find *"a rise in house prices will not only increase the market value of the wealth of house owners, but also reflect a higher cost of consuming housing services for both owner-occupiers… and tenants…"(ECB, 2003, p 9).* On empirical analysis is concluded that *"some authors have tried to quantify the effects of variations in house prices and housing wealth on economic activity in general and on consumption in particular. Not surprisingly, the empirical results are often mixed…Overall, the results could be consistent with a positive effect of changes in house prices on consumption, but the precise magnitude of such an effect remains unclear for most EU countries."* (ECB, 2003, pp. 11-12).

In Denmark the political discussion stopped, when the government joined the Economic Council's and the central bank's direct versus indirect advice on to tighten the taxation of the owner-occupiers. In accordance with the MONA report the result became that *"the increase in house prices has proved to be surprisingly robust after a reduction of the tax deductibility of interest payments in 1998."* (Danmarks Nationalbank, 2003, p. 46). This view is repeated by Pedersen (2004, p. 25): *"A house price relation of the above nature is not fully able to explain the increases in cash prices in recent years. This is illustrated by positive residuals since 1998…"*

Since 1998 has been seen a deciding break as the earlier close positive correlation between the increase in the real house prices and the consumption/income ratio has been interrupted. Instead after 1998 the correlation has been negative as seen in Figure 2 below.

Figure 2.
Real house prices indices and the consumption/income ratio. 1975 – 2004.



Source: Estimated on MONA. by stud. polit. Henrik Pedersen.

The explanation on the negative correlation between the changes in real house prices and the private consumption/income ratio is hardly that the steep rising house prices had lowered the consumption and increased the saving. However to be remembered, the combination of increasing debt and lower interest rates mean that the owner-occupiers' net interest expenditures part of the gross income has been unchanged (see Table 9) and by this their debt services must have increased[15]. Presumable the causes are mostly a mixture of the technical content of data, of changing conditions and – not at least – changing behaviour:

a) Technically the household sector has not been separated from the whole private sector (Danmarks Nationalbank, 2003, p. 119), i.e. private consumption/income ratio has not been estimated solely for the owner-occupiers, not only for the households, but for all households and firms.
b) Technically the average bond rate at the capital market is used in MONA as mentioned without respecting that the debt services are influenced by the adjustable-rate mortgages, whose market share has grown from few per cent in 1998 and to 46% now.
c) Increased saving
    1. The interest rate drop has made an increased pension saving necessary to reach a given target for the future pension incomes.
    2. Higher house prices could give the potential buyers an incitement to save more before the buying. Certainly the net liability/housing wealth ratios have not been improved since 1998 for younger owner-occupiers (Lunde,

[15] For the widely used annuity loans, a reduction in the interest rates mean the instalment's part of the debt service is increased. – Moreover, interest-only mortgage could only get an influence for the year 2004.

2005b), but, the higher house prices demand nominally and in real terms a higher amount as down payment.

d) The rather quick extension of the adjustable-rate mortgage loans and the easy access to raise mortgage and to finance a house buying can have released a special and remarkable increase in the prises for houses and flats and in raising new loans with security in the owner-occupied dwellings. Even though in theory such changes should have a once-for-all character, easily the influence could be spread over some years. *As houses and flats mostly are leveraged investments, this effect does not influence the private consumption. In addition the unchanged net interest expenditure/income ratios (see Table 9) are servicing a much higher debt and by this higher house prices. This happens especially, when financed with the new adjustable-rate mortgages, but into a minor degree also at financing with fixed interest mortgages at the lower interest level.* As in general the owner-occupiers' net liability/housing wealth ratios have been stable through the years 1987-2002, as the net liability/income ratios have increased through the period, the housing wealth/income ratios have increased too, as seen in Table 4 – and vice versa, see (Lunde, 2005a; 2005b).
e) Widespread herd behaviour or speculation. Even though the documentation is dubious the population seem to have positive expectations on, that the prices on houses and flats will continue to increase more than the consumer prices and that the interest rate level will remain low (see Section 3 above). These expectations could drive the prices somehow without basis in fundamentals or in the private consumption.
f) In reality no reliable causal explanation exists that a high positive correlation should exist on the changes in the house prices and in the private consumption (the consumption/income ratio). Perhaps only in periods with general strong positive consumer expectations on the economic growth and the stability in the society, the house prices as well as the private consumption will increase – and vice versa at pessimistic expectations for the future. At an international comparison for the years 1970-1992 the correlation was analysed and some countries had no correlation between the changes in the house prices rise and in the private consumption/income ratio or the correlation was weak (Kennedy & Andersen, 1994).

However, a clear conclusion on the many possible explanations on, why the former positive correlation between the house price changes and the private consumption/income ratio seem to fail, is not obvious. The possible explanations can lead to,

- the causality is partly false,
- still the house price rise must be explained by fundamentals as a consequence of a transition to a "new economy" with short interest rates to determine the house prices
- a "bubble" is found in the houses price as a consequence of herd behaviour, unrealistic expectations and speculation.

10. The risks for owner-occupiers and on the market for owner-occupation

Also at the market for owner-occupied dwellings, investing and financing is decided at uncertainty.

The largest risk factor is connected to the changes in the house and flat prices. For the single house or flat the risk can be seen as a combined risk, where the general price risk measured by a general house price indices has to be increased by a regional and local dimension. Further a specific risk on the changes in the specific house's, flat's and summer cottage's value must be added. At buying the investor accept a range of risk factors around the quality of the house and the special location. Moreover can be added risk on the operational and maintenance conditions.

The mortgage and other loans raised to finance the property contain risk too. Variable bank loans and adjustable-rate mortgage loans carry a liquidity risk on the payments, while the debt is nearly unchanged at changes in the market interest rates. If an interest rate increase result in a price drop for the house or flat, easily the owner with an adjustable-rate mortgage and a bank loan above can end up in negative equity. If the mortgage carry a fixed interest rate, the interest rate increase results in, the market value of the loan debt drops a lot, and for the most this owner avoid negative equity.[16]

In a situation, where the owner-occupier is exposed to a price drop on his owner-occupied house, his (housing) wealth drops too. On the other hand the house price fall has as a consequence that the net present value of the future housing services from the house drops with the same amount. In reality, the wealth position for the owner-occupier is unchanged. On the contrary the risk is linked to the owner-occupiers' debt situation and negative equity can appear. Nothing happens by the negative equity, if the owner-occupier pay the agreed debt services and other commitments. If the owner-occupier with negative equity become unable to pay, creditors with security in the house or flat can take control over the property after a foreclosure.

In the periods with falling real house prices, a high number of foreclosures – annually similar to 1/6 of the sold houses – appeared for houses, flats and summer cottages. Since 1994, foreclosures have been very few.

A new study on the development in the owner-occupiers' capital structure 1987-2002 can be understood as an analysis of the financial stability among the owner-occupiers and in the market for owner-occupied properties, (Lunde, 2005b). From the conclusion, parts can be referred:

The debt (net liabilities) has been rising in general as well as for owner-occupiers in all age groups. The growth in net liabilities took-of in 1994 and for the younger owner-occupiers the debt more than doubled, obviously a rise in real terms.

The owner-occupier's net liabilities have been compared with the value of their owner-occupied properties, i.e. their housing wealth in ratios. In general the distribution of the owner-occupiers after size of the net liability/housing wealth ratio has been nearly the same through the years in the study.

The net liability/housing wealth ratio strongly decreases with increasing age. But within the younger age groups the capital structure has not been improved in direction of a better equity ratio or contrary not been worsened through the 15 years after 1987. Through 1988-2002 among 40 and 50% of the owner-occupiers between 30-39 years of age were technically insolvent, i.e. they have had negative equity as their net liabilities were larger than their housing wealth. Also, it is shown that the older owner-occupiers had experienced a little debt rise.

However to be remarked, necessarily the publicly assessed property values for the owner-occupied properties have been used to measure housing wealth instead of "true" market values and this influence the results. In average the assessed property values underestimate the prices for sold houses with a tenth but with some variance in the single sale observations. This methodological

[16] Opposite, a drop in the market interest rate for a fixed interest loan would increase the value of the bonds and by this the market value of the fixed interest loan. At stagnating or even dropping house prices, this debt increase – as for 1987-1993 – contributes to create negative equity. In practise, this risk has been minimised to day as new fixed interest mortgages only are offered by the mortgage banks, when their prices are slightly below 100.

problem means that the *estimated* net liability/housing wealth ratios can only be seen as *indicators* of the true ratios. As this problem has been the same through the inspected years, the presented conclusions on the stability of the stability of the net liability/housing wealth ratios are not affected.

Similar methodological reservation does not exist in relation to the owner-occupiers net liabilities, interest incomes and expenditures.

As the family's income is the base for paying debt services on the loans, the owner-occupier families' net liability/income ratios have been analysed. In 2002 the median value for all owner-occupiers was 125, i.e. the median owner-occupier family had a net liability, which amounted to 125% of their gross income in 2002. For the most indebted 10% the net liability were at least three times as high as their income. Half of the owners between 30-39 years of age had net liabilities at more than twice their income and the most indebted 10% had a ratio above 340.

Since 1994 the owner-occupiers' net liabilities had increased much more than their incomes, as the median value of the net liability /income ratio for all the owner-occupiers have increased 71% and for owner-occupiers between 30-39 years of age with 54%. Presumably the owner-occupiers are more indebted than ever before. This can be seen as if the owner-occupation sector – an important part of the Danish economy – has been influenced by a higher degree of financial fragility.

At last the owner-occupiers net interest expenditures/income ratios have been analysed as referred in Section 9. At an examination of the financial stability in the owner-occupation sector a positive result is that the net interest expenditure/income ratios are laying at a somehow lower level than in 1987, at the start of the "housing market failure". However, the change is less convincing in an after-tax comparison. A rough conclusion is that after inclusion of changes in interest rates, increasing debt and changed tax rates, the owner-occupiers' interest payments after tax is covering about the same part of their gross income in 2002 as in 1987. Moreover obvious, in average the owner-occupiers have attained a higher risk position than in 1987 at more strong interest increases as 46% of the owner-occupiers' mortgage debt carry adjustable rates (February 2005). An interest rate increase at few percentage points would bring this part of the owner-occupiers' net interest expenditure/income ratios back at the 1987-level – and the after-tax ratios even higher up.

During the "housing market failure" at the Danish housing market 1987-1993, around 20-25% of the owner-occupiers were technical insolvent. A part of the failure was mass foreclosures. Possibly the most surprising aspect at the development in the owner-occupiers' capital structure as shown above was, the frequency of technical insolvency was nearly as high in the years after 1993 as through the "housing market failure". A conclusion of the paper is therefore that negative equity exists as a permanent feature of the Danish house market. Another conclusion must be that one or more "trigger-factors" must be active to release new crises at the market for owner-occupied houses and flats. *A widespread existence of technical insolvency is not by itself a cause to a new crisis.*

11. Conclusions – Stabilising prices on houses and flats through the economic policy?

This paper itself is a summary over 30 years' development and changing economic conditions for the Danish owner-occupiers. The importance for the house prices of the taxation on owner-occupiers, of the interest payments and of general financial conditions has been emphasized. The taxation policy has – mostly – been tightened through three tax reform for owner-occupiers, especially at the reduced tax value of the interest rate deductions in taxable income. The mortgage

system had been highly influenced by political decided restrictions and then by deregulations or liberalising of the market, which has lead to mortgage product innovations. Besides, the monetary policy, especially through the interest rate setting, is of highly importance for owner-occupation.

The focus in the paper has been placed upon the boom and busts in Danish house prices and at the factors influencing these prices. A central point in the paper is that actually a “bubble” seems to be under creation.

An obvious proposal would be to try to stabilise prices on owner-occupied houses and flats. Such a target looks even more important than to stabilise prices on bread and butter as the fulfilment of the non-inflation target is always measured by the consumer price indices.

However, the possible economic-policy measures to be used to stabilise the rate of price increase on houses and flats in a way the general inflation rate is shadowed, are not easy to find.

For example, the actual steep price rise for houses and flats in Denmark could be stopped by tightening the property value tax. Such an increase in the tax rate would be capitalised as lower prices on houses and flats and would release a less steep price rise or even a price drop. At the very long term the demand for owner-occupied dwellings would be weakened and the housing quantity in owner-occupation would be reduced, especially if the conditions for the other tenures are unchanged.

After a combined tax increase and house price reduction, the housing expenditures and user costs at buying would more or less be the same. Therefore an increase in the property value tax would only lead to that housing wealth is transferred to the state from the owners, who get an once for all capital loss and less capital gains later on.

Changes in taxation are structural policy. Also a fine tuning afterwards, due to changing conditions for the owner-occupiers in the future seems rather difficult to match. Moreover the timing of such policy measures can be discussed as they sometimes came into effects too late – after the conditions, they are directed against, already have changed.

The Danish introduction of interest-only mortgages at October 2003 acts as an example on an unfavourable timing. The liquidity oriented housing demand reacted – into an unknown degree – with an additional pressure on house prices and especially on prices for owner-occupied flats and summer cottages.

The risk on conflicting targets is obvious. As mentioned the central bank’s single objective of monetary and foreign-exchange policy is to keep the krone stable against the euro. Including targets as property and share price stability could result in somehow higher spread between the krone interest rates and euro interest rates. Such a permanent interest rate increase would of course make the financing of owner-occupied dwellings more expensive.

The conflicting targets have already been observed, because the property prices are not included in the target for the monetary policy. The international efforts to lower the interest rates after September 11. 2001 were targeted to stimulate the economic activity. However, this interest rate policy seem for the most to be transmitted to the real economy through higher prices on owner-

occupied dwellings and through the owner-occupiers' withdrawal of equity at raising long-term mortgages.

Considerations on how to avoid boom and busts in house prices are in reality considerations on how to avoid economic cycles. The housing fluctuation problem is that the variability in prices for houses, flats and summer cottages are much higher than on ordinary consumer goods. However, this is created by the effort of both the exogenous factors – as mostly discussed in this paper – and of the endogenous factors' influence on the owner-occupation market itself.

In all an active economic policy to govern the cycles on the owner-occupation market seems rather difficult to establish. Contrary, defensive policies where that the government and the central bank accept to let the economic policy conditions – the exogenous factors – remain unchanged through the years. Such a defensive policy seems to be the best guidance for stabilising the owner-occupation market and reducing the house price cycles. Of obvious reasons, such a policy could be difficult to follow.

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