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The Housing and Credit Affordability for Danish Owner-Occupiers During the Recent Boom and Bust Period

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Executive Summary

The purpose of this paper is to study the Danish housing market development during the 1993- 2010 period on the background of the international financial crisis, international research and general economic theories.

I started the analysis by pointing out the following imbalances: the favorable economic conditions during the recent housing boom times (2000-2006), such as low interest rate, low unemployment, increased earnings potentials and increased housing wealth improved households' ability to borrow. On the other hand, the skyrocketing increase in housing prices did not improve households' ability to buy and sustain a house. However, banks continued to lend and borrowers continued to borrow, because of a general belief that housing prices would only increase in the future, and if they did not buy now, they would not be able to afford it later.

This irrational behavior led to an over-optimistic assessment of borrowing ability, risk under-estimation and over-indebtedness. All this further contributed to increased level of forced sales, negative equity, bank looses and write-downs- the sources of imbalances on housing and credit markets.

I emphasized that affordability is a measurable concept that might serve as a tool to better sustain the housing market from imbalances, by describing house buyers' *present* ability to invest in real estate. Therefore, I aimed to investigate how housing and credit affordability developed without relying on over-optimistic expectations.

To approach the analysis, I addressed the usefulness of the affordability concepts, by distinguishing between *housing affordability* and *credit affordability*.

Applying *price-to-income ratio*- the measure of housing affordability- it appeared that the growth in housing price did not coincide with the growth in gross national income or net disposable income. So, price-to-income correlation was not in equilibrium.

Applying *interest burden measure* and *financial margin ratio*- the measures of credit affordability- the evidence has shown that credit affordability was the main single factor explaining the evolution of housing boom. Thus, the decline in interest burdens of owner-occupiers was pointed out to be the main driving power in housing purchase decisions. However, taking risk factors into account, such as increased exposure to interest rate risk, increased housing volatility and increased indebtedness, Danish owner-occupiers' vulnerabilities also increased.

Therefore, I stressed that housing affordability has to be superior to credit affordability. I recommended that lending that is based on the housing affordability approach, will prevent irrational behavior, over-indebtedness and promote stability on the housing market.

Introduction

In 2008, the global economy was hit by a crisis, compared to the Great Depression in the 1930's (Reinhart and Rogoff, 2009; Taylor, 2009a). According to Danmarks Nationalbank (2010), the crisis was the outcome of imbalances, such as strong credit growth, increased residential investment and large current-account deficit that had been accumulating for some time.

One of the main questions for liberal economists was:"could those imbalances have been foreseen before the bust?" Some indicators can give early warnings about financial imbalances (see for example, Lunde, 2008b), but they cannot predict exactly when a possible crisis will erupt.

Since the crisis erupted, studies attempted to identify the triggers. Academics seem to agree on housing and credit markets as the dominant triggers for the crisis (see among others Eichengreen, 2008; Bordo, 2008, Taylor, 2009a; Krugman, 2009; Allen, and Gale, 2007; Mishkin, 2009; Akerlof and Shiller, 2009).

Therefore, in this project I shall investigate the housing and credit markets in Denmark for the period 1993- 2010.

In Denmark, the latest housing boom began in 1993 (see figure 2 in appendix 2A and tables 1-2 in appendix B). Then prices soared and peaked in 2006. The average housing prices of total sales were 258% higher than in 1992 in nominal terms. From 2006 till 2010, the total house prices have fallen by 19 %, the biggest fall since the 80's.

Not only the housing market, but also the lending sector, experienced this boom and bust. In Denmark, the total bank lending increased by 327 % in nominal terms during the period 1993- 2008, and total mortgage lending increased by 242 % during the corresponding period (see tables 29, 33 in appendix 20A). The year 2008 is the year where the first fall in lending activities is seen followed by the turmoil on the financial markets. During the period 2008- 2010, the total bank lending to the private sector declined by more than 20 %. In 2008, lending growth fell to below the average for 1991- 2008 (Danmarks Nationalbank, 2009).

Therefore, I assume the boom and bust on housing and credit markets could have sent some early warnings. It is my underlying goal to investigate and measure the imbalances on housing and credit markets during the boom and bust period, focusing on demand-side conditions

1 Housing Market's Developments and its Problem Areas

1.1 Problem areas

The booming housing market made mortgage loans look safe, risk factors negligible and the wide economy and financial stability seemed strong. For example, the report on Financial Stability in Denmark (Danmarks Nationalbank, 2007) stated: *"there is no immediate risk to financial stability from the general economic development and falling housing prices"* (p.5).

The households' strong financial position was emphasized by a *very low level of enforced sales*. It created therefore *housing wealth* in step with the surge in housing prices (especially from 2003). And, with the historically *low interest rate* at 2 percent since 2000 and the *favourable economic conditions*, the households' *borrowing capacity* improved (see figures 5-13 in appendix 3A). Thus, lending activities increased as housing prices surged, and the general belief was: *"there is no reason to expect a general housing price dive for as long as the economy remains strong"* (Danmarks Nationalbank 2007, p.6). And, should the borrower be in a default situation, he might just refinance his mortgage or sell his house when housing prices are soaring (Green and Wachter, 2007).

However, the increase in housing prices did not improve households' *ability to buy a house*. And the reduction of the tax value of deductible interest payments (down from 46% in 1998 to 33% in 2002) negatively affected homeowners as their net disposable income decreased (Mortensen and Seabrook, 2009).

With higher housing prices the households would find housing purchase less affordable, limiting housing demand (Girouard *et al*., 2006). Theoretically, the limited housing demand should have put a pressure on housing prices. In reality, the increase in housing prices gave people an incentive to buy early in order to protect themselves against the risk of a further price increase that would make houses unaffordable (Shiller, 2007). The possibility of housing downturn was not even mentioned. Thus, the belief in constant house price increase was a motivating factor in lending, borrowing and housing purchase decision (Akerlof and Shiller, 2009).

In this project I would like to investigate how housing affordability and credit affordability have developed without relying on the expectation of future house price increase. I look at actual housing and credit affordability, as a "tool" to sustain the housing market from imbalances.

Therefore, my investigation area is: **The housing and credit affordability for Danish owner-occupiers through the recent boom and bust period in the light of relevant theoretical argumentation, definitions, measures, and applications.**

1.2 Problem formulation

The problems with the affordability of mortgages for homeowners may lead to crises in both mortgage markets and housing markets (as in the UK in 1991 and the USA in 2006-07). The affordability problems (or crisis) increases the level of forced sales, negative equity, bank losses and write- downs (Bramley, 2010). Those conditions, in fact, are threats to financial stability (Mishkin, 2007).

However, because the concept of housing affordability is not widely used, there are no generally accepted measures. "*To date, lenders have had considerable flexibility in how they assess affordability, and in some cases firms have used inadequate criteria and over-relied on house prices"* (Financial Service Authorities, 2010, p. 8). In addition, "*affordability is still not fully accepted and enshrined in agreed standards, partly due to different views about how it should be measured and at what thresholds*" (Bramley, 2010, p. 17).

It seems that this is a critical area, which requires further research and guidance. In the UK, The Financial Services Authority (FSA, 2010) raised the need of uniform industry norms for assessing potential loans in terms of their "affordability". The Consumer Affairs Directorate (2001, 2003) raised the need to invest in the development of a better concept of affordability in order to deal with over-indebtedness. According to Finlay (2006), there is a need to construct statistically significant models of affordability. Consequently, there is a need to study the concept of affordability, because the concept of affordability is important to the housing market and financial stability. It may limit threats to stability, such as speculation, over-optimism, and housing booms. On this background, my problem formulation is:

How had housing prices and the level of housing affordability developed in Denmark during the 1993- 2010 period?

I answer the question raised in the problem formulation by studying the following sub-problems:

1. What are housing affordability and housing affordability approaches and measures?
2. Do changes in housing affordability bring housing prices back towards long-term equilibrium?
3. What are credit affordability and credit affordability measures?
4. How did housing and credit affordability evolve in Denmark since 1993?
5. Which imbalances on the housing market can be found by using housing affordability and credit affordability approach (indicators of housing affordability change)?
6. What should the projected housing price level have been if the prices were in equilibrium with housing affordability (price- income equilibrium)?

1.3 Methodology and project design

1.3.1 The aim of the project

In this project I shall seek to analyse both the housing prices developments and the credit market conditions from 1993 until 2010 with an aim to find the indicators of imbalances. I shall focus on main areas:

1. The relationships between housing prices and income developments (housing affordability)
2. The recent credit market dynamics, with focus on demand- driven factors (credit affordability)

1.3.2 Structure and analytic strategies

The project is divided in five chapters, illustrated in appendix 1A.

The first chapter is the introductory chapter. The second chapter of the project is dedicated to the concept of housing affordability. I define the concept of housing affordability based on literature overview. I then give reasons to expect that housing affordability should bring housing price back towards equilibrium. For this purpose, I set up a theoretical framework to explain the reasons why housing affordability measure is a benchmark for long-term housing price equilibrium. I will also extend the housing affordability concept by discussing the benefits of using the housing affordability concept in practice. I analyse how housing affordability has developed during the most recent boom and bust periods. I finally outline the main imbalances on the housing market from the housing affordability perspective.

The third chapter is dedicated to the credit affordability concept. First, I discuss the role of credit developments and financial markets developments in the housing market from theoretical perspectives. Then, I outline general trends in credit (mortgage) developments in Denmark. Hereafter, I propose a credit affordability measures to assess the development of credit aggregates based on literature overview. The benefits of using credit affordability in practice will be discussed as well. Subsequently, I assess the development of credit affordability for Danish households and outline imbalances from the credit affordability perspective. I also assess external factors that affect housing and credit affordability assessment.

In the fourth chapter, I derive a model to measure housing prices based on the assumption that average housing price should be in balance with housing affordability. The variables for this model will be derived from the theoretical and practical analyses of housing and credit affordability concepts. In a conclusion chapter five, I sum op the main points and findings. I also suggest recommendations according housing and credit affordability concepts. A new perspective on the affordability concepts and derived model will be presented as well.

1.4 Data

The analysis is conducted on an aggregate level and on a household level.

The data based on the aggregate level are provided by Thomson Reuters DataStream, mainly based on Danmarks Statistics, Danmarks Nationalbank and Association of Danish Mortgage Banks database. The aggregate data include all individuals' income, expenditure as well as total banks' lending. However, these do not distinguish households' demographics, and therefore the analysis across demographic is not possible.

Consequently, the main source for the analysis on household level is a data extract from Statistics Denmark on a conducted survey "*Investigation of consumption*" (www. dst.dk- income, consumption in prices). It contains the information on incomes, expenditures, asset and liabilities for different dwelling types, occupation groups, income groups, age categories, socio-economic status, household types, i.e. the main variables of a credit scoring system (a system that measures creditworthiness).

In my analyses, the data on the household level distinguish households by dwelling type. I focus primarily on a survey for house owner-occupiers and flat owner-occupiers. Where relevant, I compare with tenants of rented flats and houses. In addition, I extend the analysis by occupation and education status, the income group and household type. The analysis will be provided in appendix.

Table 1 shows the average characteristics of Danish households during 1993- 2008. In the this table, they are presented in three columns: total in Denmark, owner-occupier detached houses and owner-occupier flats, respectively, for a modelised family (for extended data, see table 1 in appendix B):

Table 1: Households' characteristics

	total in Denmark	Owner-occupied detached house	Owner-occupied flat
Households in Denmark - thousands	2484	1259	167
Persons in Denmark - thousands	5256	1172	119
Persons per household	2,1	2,5	1,7
Of whom adults	1,6	1,9	1,4
Of whom children	0,5	0,6	0,3
Of whom homeowners	0,5	1	1
Age of head of household	48	51	44
Size of dwelling, square metres	107	136	84
Year of construction	1948	1947	1940

Source: Danish Statistics, investigation of consumption and own calculations

Thus, the average flat owner-occupier model household consist of 1, 7 persons, of whom 1, 4 adults and 0, 3 children. The average size of a dwelling is 84 square meters. The average house owner-occupier household consist of 2, 5 persons, of whom 1, 9 adults and 0, 6 children. The average size of a dwelling is 136 square meters.

It is further assumed that the average household pays the average price for a flat or a house.

1.5 Reliability of the project

There are three central factors in assessing the reliability of my project: my theoretical analysis, my data analysis and the method I apply.

First of all, my theoretical analysis is supported by academic literature, theoretical assumptions and empirical results. The argumentation has a high reliability because respected sources of literature and respected authors were used. The periodicals (*The Economist, New York Times, Børsen*) were used in my studies. However, I used this information as a background.

Secondly, only primary data were used for the analysis: Danmarks Statistics, Danmarks Nationalbank and Association of Danish Mortgage Banks. On average, their statistical methods are updated regularly, their data are treated with more precision, their publications are swifter on-line than off-line, their confidentiality control is very strictly enforced, and the access to their data bases is pleasantly user-friendly. In terms of comparability over time, the statistics are fully comparable over time. Thus, these data are very reliable (www.dst.dk- declaration of content).

And, at last, to solve the last sub-problem (where I estimated the level of housing prices) I applied residual-income approach. A range of objective assumptions were made, which is subject to discussion. However, it is a general problem in Modern Finance. Therefore, the assumptions were also supported by historical developments (derived in my analysis), academic literature and examples from practice.

1.6 Limitations

The individual characteristics of houses are disregarded: their size, location, design, state of repair, neighbouring characteristics, which have different effects on price and therefore on housing affordability. Therefore, I assume that houses are comparable it terms of affordability. Thus, the aggregate (average) prices will be used to derive the affordability for the average household.

The households' characteristics such as the place of work, occupation, sex, number of children and years of working at the current place are important in measuring credit affordability on the household level (Finlay, 2009; Capon, 1982, Hale, 1983). Not all these demographics are available by Danmarks Statistics, and therefore they can not be taken into consideration.

Due to the lack of data, the credit affordability analysis does not specify the level of debt of the household or the type of a mortgage debt to a corresponding dwelling type or other demographic groups.

The limitations of housing and credit affordability measures will be discussed in details through the analysis.

1.7 The housing market cycle/ crisis

1.7.1 Boom in housing prices (2003- 2006)

Denmark has experienced three housing cycles during the past three decades (Skaarup and Bødker, 2010). The latest one began in 1993 and prices peaked in 2006 (see appendix 2A), lasting 13 years (while previous up- and downturns have lasted 3 to 5 years, Skaarup and Bødker, 2010). Since 1993, average housing prices of single- family houses and owner- occupied flats were continuously increasing: by the end of 2006, they were 227% and 327% (in nominal terms) respectively higher than in 1993 (see tables 2- 4 for the data in appendix B). Especially, between 2003:Q1 and 2006:Q4, there were very large price rises: the prices for single-family houses and owner-occupied flats increased by 50 % and 68 % correspondingly in nominal terms.

When prices soared, the overconfidence took over. According to Shiller (2008), buyers believed the investment in houses at a given time was the best time. They believed that the prices for housing will only increase in the future. Buying property begin almost at any price, as people believed, if they will not buy it now, they will not afford to buy a house later. Akerlof and Shiller (2009) in their book "Animal spirits" called it a "*housing speculative fever*" (p. 169) that was mainly driven by irrational confidence in a bright future and constant house price increase.

As housing prices soared, housing buyers' motives also changed - it is no more a shelter, but an investment object. In Denmark, according to Mortensen and Seabrook (2009), there has been major transformation of viewing residential property, "*a gradual shift from seeing housing as a social right toward viewing it as a means to wealth"* (Mortensen and Seabrook, 2009, p.122).

In addition, the demand for housing was driven by the desire to gain a high return on equity (Lunde, 2007a; Shiller, 2005), or, to come into the possession of easy source of wealth- "*buying for the future price increases, rather than simply for the pleasure of occupation"* (Case and Shiller, 2003, p. 321). The increase in housing prices was the main motive to buy a house and "*investors [first- time buyers] rush to get on the train before it leaves the station and accelerates"* (Kindleberger and Aliber, 2005, p.27).

Thus, the speculation boom in the housing market began. From 2003 till 2006, the housing prices could not be explained by fundamentals any more. Finally, the housing market fulfilled the criteria of a bubble (Lunde, 2007).

Positive thinking in boom times and speculation increased demand and supply for credit (Shiller, 2008). With increasing housing prices, lending would be seeing more affordable to borrowers with

poor credit histories (Muellbauer and Murphy, 2008). If a borrower was not able to pay a mortgage cost, a lender might liquidate a house and gain a return. That was a rational explanation in lending to low-income families (Green and Wachter, 2007; Allen and Gale, 2007). Thus, the viability of these loans depended almost entirely on rapid appreciation in house prices (Hoenig, 2008).

This belief prompted irrational behaviour within lenders, such as dramatically loosening credit standards, lending more against each property and cutting the need for documentation. (Danmarks Nationalbank, 2007)- "*a natural tendency for declining credit standards in boom times*" (Minsky, 2008, p.2).

As housing prices grew, the borrowers and lenders had more incentives to lend and borrow in search of easy returns, wealth, fees, and bonuses (Kindlerberger and Aliber, 2005). They made money through the volume of transactions, but had little or no responsibility for the quality of the loans that were made (Hoenig, 2008).

The associated increase in borrowing, housing prices and risks left Danish owner-occupiers as the most highly indebted in the OECD countries (Lunde, 2008b). According to Hansen, Meding and Østrup (2009, p. 19), 32, 2 per cent and 31, 9 percent of a research sample population[1] had in 2005 and 2006 a debt that was higher than its assets (a negative net wealth[2]).

1.7.2 Bust in housing prices (2006- 2010)

In 2006:Q3, the housing market began to cool down, and we observed the first housing decrease (by 2 % in total sales price from 2006:Q4- 2007:Q4). However, people did not notice this fall (Krugman, 2009). And only after 2009 there was a severe decrease in housing prices. Housing prices fell by about 18 per cent in two years from 2007:Q4 till 2009:Q4 (in nominal terms). According to Lunde (2008a), "*the background for the housing price downturn cannot be found in any special "trigger factor", or shock*" (p.4). Still, this severe downturn can partly be explained by recession. In Denmark, in 2008, GDP fell by 1.1 %, "*so that growth was negative for the first time in 15 years*" (Danmarks Nationalbank, 2009, p.23), Also, the bankruptcy of the Wall street bank, Lehman Brothers, which turned the liquidity crisis into a global credit crunch, and turmoil of the credit market resulting in worldwide credit market halt (froze), can be seen as a trigger for housing downturn (Bordo, 2008).

Falling housing prices tend to *reduce the wealth of households and the assets of financial institutions.* When housing prices begin to fall substantially, many borrowers have "negative equity" (Lunde, 2008a)- when a mortgage loans are higher then the value of their houses. Higher payments (with the adjustable mortgage rate) and negative equity are a toxic combination for the housing

[1] The research is based on 5151 individuals from Statistics of Denmark
[2] Net wealth is derived as the amount of assets subtracted by the amount of debt

market and a direct threat to the financial markets. Especially, illiquid with negative equity owner-occupiers pose the biggest threat to housing market (Lunde, 2008a). As defaulted borrowers (illiquid) are forced to sell their houses at discount (because of higher interest payments or less income) it exacerbates the problem of forced sales, putting more pressure on housing prices.

This creates a vicious cycle or downwards spiral. Banks will therefore have more incentives to tighten their credit policies towards household and corporate sectors. Companies, facing liquidity problems, might shrink investments and their return on equity. Lower earnings will again send negative signals to financial institutions. When banks respond by further tightening credit standards, and cutting back on lending, this leads to a weakening of the real economic development. A lower economic growth increases the risk of loan defaults and increases the number of enforced sales (foreclosures). Negative development further decreases housing prices, and banks are reluctant to lending even further[3] (Danmarks Nationalbank, 2009).

Also, the financial institutions' asset side of their balance sheets will shrink, leading to de-leveraging (Adrian and Shin, 2008). Then financial institutions sell their assets. This, in turn, causes a new shift in the equilibrium price (Miles, 1994; Muellbauer and Murphy, 2008). This is a new "shock" to the housing market.

When it has become more difficult to borrow, and the number of repossessions is soaring, an increase of houses for sale and sale time is the result. All this affects the construction sector, probably the main channel how housing crisis can spread to the wider economy. Building activities and residential investments diminish. In this way, job losses in construction and related industries become one of the main reasons for decrease in GDP growth rate (Foster and Magdoff, 2009). According to Lunde (2008a), "*the beginning downturn in housing prices would only have a weak influence on the housing market and the wider economy, if mortgages or other credit were not available and houses and flats had not been used as collateral*" (p.10). Because of links between the housing market and the financial market via debt, the real estate has dangerous qualities.

Furthermore, measuring housing price volatility (see figure 3 in appendix 2A), the housing market have became more volatile since 2003.Thus, the period from 2003 till 2006 is therefore defined as a period of housing boom and from 2006 till 2009 as a period of housing bust.

To complement the preliminary introduction into housing market, I introduce the reader to the Danish mortgage finance system.

[3] This so- called "financial accelerator" mechanism that creates a downwards spiral (Bernanke, 1998)

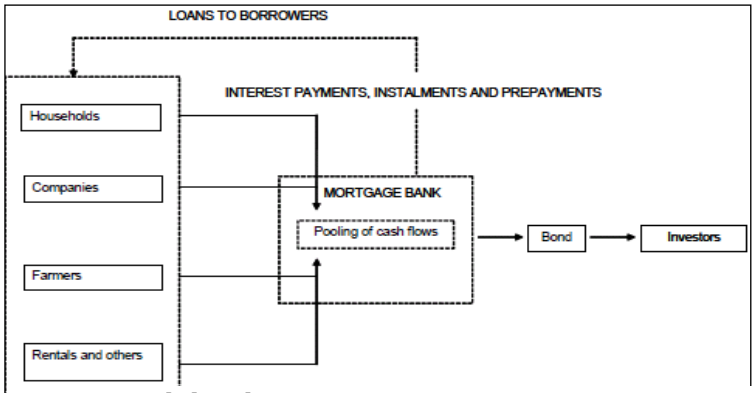
1.8 The Danish mortgage finance system

Mortgage finance is the primary source of real estate financing in Denmark. The mortgage market supplies long-term financing to housing, a mortgage loan.

Moreover, mortgage banks are intermediary between investor and debtor. First, a mortgage bank grants a loan to the borrower based on the collateral of the property. It then issues a bond to fund the loan. Subsequently, mortgage institutions act as the mortgage intermediate, with the responsibility for collecting payments from borrowers and redistributing them to bondholders (Frankel *et al.*, 2004).

The process is demonstrated by the following figure:

Figure 1 Danish Mortgage Market System



Source: Frankel et al., 2004

In Denmark, the biggest mortgage credit institutes are: Realkredit Danmark, Nordea Kredit, Nykredit Realkredit, Totalkredit, DLR Kredit, BRFkredit and LR Realkredit (Juul, 2006). Some of the institutions are linked to other financial enterprises, either as a parent or as a subsidiary.

According to The Danish Bankers Association, in 2009, the Danish mortgage finance contributed 29, 23 % to the total financial sector balance with DKK Billion 1,102 (www. finansraadet.dk- Tal & Facta).

The Danish mortgage finance system is generally considered to be very safe when it comes to the ability of issuers to meet their obligations against bondholders, and no Danish mortgage bank has ever been declared bankrupt.

For example, Nykredit bonds are characterized by a high degree of security as a result of both the Danish mortgage finance legislation and mortgage institutions credit policies. The ratings assigned by Moody's and Standard & Poor's directly reflect the security of the bonds. The Danish market is generally characterized as an Aaa mortgage bond market (www. nykredit.dk- Danish Covered Bonds).

Therefore, the Danish mortgage market was characterized as "*one of the world's most sophisticated housing finance market*" (Frankel *et al.*, 2004, p.95) "*and the most robust mortgage system in the world*" (*The Economist*, 2007). The special role in housing upturn gives borrowers flexibility in paying back loans, which makes the system so different from other systems (Frankel

et al., 2004). The combination of fixed interest rates and an option of prepayment help to shield borrowers from interest rate risk. If rates rise, buyers are protected by fixed interest rates; if rates fall, they can take out a new mortgage at a lower rate and prepay the old one and still earn capital gains.

Because of the option of prepayment, it is the investors who are exposed to prepayment and thus re-investment risk (Frankel *et al*., 2004). Therefore, the borrowers' mortgage loans are free from the interest rate risk. This is a substantial factor in underlying mortgage valuation. The mortgage debt is, therefore, cheaper compared to other debts (also the value of collateral makes mortgage debt the cheapest among others).

Thus, in general and especially in Denmark, the housing market and the housing prices are important for the national economy and for the financial markets. In the next chapter, I analyze whether the increased housing demand and prices were supported by improved housing affordability. To do this, I study the concept of housing affordability.

2 Housing Affordability

The notion of "affordable housing" came into vogue in the 1980's (Stone, 2006). Since then, "affordability" has become a common, even ubiquitous concept in housing policy discourse (Bramley, 2010). It became popular in public discussions and in the real estate industry (Rae and van den Noord, 2006), but, there are still no formal definitions of housing and credit affordability (Czischke, 2006; Finlay, 2006) - it still lacks a precise and consistent definition (Stone, 2006). In the following part, I aim to study the concepts of housing affordability, its strengths and weaknesses. I will discuss existing perspectives, supplement and open new perspectives by the following questions, which in fact are to be met in order to answer the problem formulation:

- What is the housing affordability concept, and how can it be measured?
- Is there a strong correlation between housing affordability and the long-term equilibrium in housing prices (According to theoretical frameworks and empirical findings)?
- What are the other perspectives on the housing affordability concept?
- How did housing affordability develop in Denmark during the boom and bust periods?
- What are the main imbalances on the housing market according to the housing affordability concept?

2.1 What is housing affordability? - Concept definition based on literature overview

The academic literature on housing affordability distinguishes several perspectives on the affordability concept.

A classical approach to understand the housing affordability concept is to see it as a relationship between housing costs and income. For example, according to Stone (2006), housing affordability is "*an expression of the social and material experiences of people, constituted as households, in relation to their individual housing situation*" (p.151) Further, "*Affordability expresses the challenge each household faces on balancing the cost of its actual or potential housing, on the one hand, and its non-housing expenditures, on the other, within the constraints of its income*" (Stone, 2006, p.151).

Housing affordability, like housing demand, dynamics depends upon the *current purchase price of housing unit, current households' resources (measured by net wealth) and future expectations in housing price development and households' resources*[4]. (Miles, 1994, p.15)

Despite the straightforwardness, *"housing affordability is not a simple question of comparing house prices to family income. Affordability is a complicated concept that is difficult to define because it is influenced by the subjective values and differing social expectations of consumers*" (Yang and Shen, 2008, p.318).

Stone (2006) defines the affordability concept as affordability in relation to housing standards: "*a household in a housing affordability problem may live in housing that fails to meet physical standards of decency, in overcrowded conditions, with insecure tenure, or in unsafe or inaccessible locations*" (p.154). If a household cannot afford satisfactory housing and residential environment, it is in an affordability problem. According to Glaeser and Gyourko (2003), it is more a poverty problem, rather than a housing affordability problem. From this perspective, Lerman and Reeder (1987) and Thalmann (1999, 2003) have developed and applied such quality-based measures, which classify a household as having an affordability problem, not on the basis of actual housing cost in relation to income, but on what it would cost to obtain housing of a basic physical standard within a given local housing market.

In my analysis, I shall examine housing affordability as a relationship between housing prices, corresponding costs and income. Accordingly, I define *housing affordability as the ability of an average household to buy and sustain an average home (housing-related costs) without being financially distressed after its purchase.* This is so- called "payment" instead of price approach.

[4] According to Miles (1994) those factors actually factors that determine housing demand. It makes sense to transpose it in relation to housing affordability.

2.2 Measures of housing affordability

Mathematically, the relationship between housing cost and incomes can be computed either as a ratio or as a difference (Stone, 2006).

2.2.1 Price-to-income ratio

The "traditional" *ratio approach* in measuring housing affordability is the price-to-income ratio, a relative measure of aggregate price vs. aggregate income (Girouard *et al*., 2006a; Yang and Shen, 2008). The housing affordability measured by the price-to-income ratio indicates whether or not a typical family could qualify for a mortgage loan on a typical home.

2.2.2 Maximum acceptable housing-related cost in relation to income.

Another ratio approach expressing housing affordability is the *maximum acceptable housing-related costs in relation to income*. It is a general rule-of-thumb that housing-related costs should not exceed 30 per cent of a families' disposable income. Housing costs considered in this guideline generally include taxes, insurance for owners, and utility costs. When the monthly carrying costs of a home exceed 30–35% of household income, then the housing is considered unaffordable for that household (www.wikipedia.org- affordable housing).

Likewise, according to studies by Glaeser and Gyourko (2008b) within housing affordability, the housing becomes "unaffordable" when costs rise above 30% of household income. Also, according to Stone (2006), a typically "affordable" housing is defined as not being above a specified proportion of household expenditure, often now 30%. As well, Czischke (2009) measured that in 2006/07 on average the percentage of households' incomes spent on housing across the EU was below the consensual threshold of affordability (30%). Finally, the Task Force in the UK (Consumer Affairs Directorate, 2001, 2003) stated that lending to a household that (will) spend on housing more than 30% is defined as irrational lending.

Thus, "*there is a widespread acceptance of the ratio of housing cost to income as the appropriate indicator of affordability and of the simple "rule of thumb" ratio standard (25 percent of income until the early 1980s, 30 percent since then) for assessing housing affordability problems, as well as for determining eligibility and payment levels, explicitly for publicly subsidized rental housing and somewhat more loosely for other rental and ownership programs and financing*" (Stone, 2006, p152).

Yet despite its widespread recognition and acceptance, there is no theoretical or logical foundation for the concept or the particular ratio or ratios that are used (Jewkes and Delgadillo, 2010).

2.2.3 The residual income approach

The residual income concept of housing affordability is another approach. It indicates the relationship between income and housing costs as a difference, rather than a ratio (Stone, 2006). A

household has a housing affordability problem if it can not meet its non-housing needs at some basic level of adequacy after paying for housing (Stone, 2006).

2.2.4 Other variables

Some studies include borrowing ability and credit costs, non-housing costs, and the current and expected housing wealth into the housing affordability determinants (Yang and Shen, 2008). Moreover, housing-related costs (Nykredit, 2002) and housing conditions (Thalmann, 1999, 2003) can be important variables.

Different approaches, variables and measures of housing affordability exist. For the summary on different approaches in measuring housing affordability, its advantages and disadvantages, see appendix 4 A.

To conclude, the main variables that determine housing affordability for the first-time buyers are the *housing price, financing cost, housing-related costs and income.* According to the accepted view, housing is unaffordable when all housing-related costs exceed 30% of a household's disposable income.

In order to answer the second sub-question, I assume that the relationship between income and price (a traditional measure of housing affordability) bring housing price into equilibrium. So, why there should be a correlation between housing affordability and housing price equilibrium will be a topic in the following section. The discussion will be based on theoretical assumptions.

2.3 Theoretical argumentation

In order to analyse the possible cause and effect relationships, it is essential that the correlation/ relationship between the cause (housing affordability) and the effect (next period's housing price, long-term equilibrium) is strong. Moreover, it is important to use a right measure (tool) to assess this correlation. If one of those criteria is not fulfilled, the analysis will not have any value.

Further, I analyse theories that support the assumption that housing affordability should bring housing prices into equilibrium. Also, the analysis of relevant theoretical assumptions might explain some of the contrasts between what are expected in theory and the facts found in practice.

2.3.1 Housing price formation under Efficient Market Hypothesis assumptions

My underlying assumption is that demand and supply factors result in housing equilibrium (Miles, 1994) - the neo-classical theoretical formulation (marginal utility, supply and demand determine housing prices). Demand for housing is a function of factors, such as demography, income, interest payment, user-cost, the availability of substitutes (Miles, 1994), demographic trends, including population growth, immigration (Rae and van den Noord, 2006), housing stock, credit availability and lagged appreciation (Muellbauer and Murphy, 2008), as well as growth in first-times buyers (Wagner, 2006).

Supply for housing in the short run is inelastic (Miles, 1994), but in the long run, supply is a function of the factors influencing construction sector activities (De Viers and Boelhouwer, 2005), such as construction level, planning controls, the tax system and the structure of local government (Muellbauer and Murphy, 2008), labour cost and cost of raw materials, as well as its availability.

Any changes in demand factors should bring housing market out of its equilibrium. However, the building constructors will react to these changes, which, in turn, will create a new equilibrium (Miles, 1994; Danmaks Nationalbank, 2003). For example, a building contractor will increase building activities if there is an increase in housing demand. This will add new houses to the stock, leading to downward pressure on housing prices.

In my studies, I disregard supply factors because supply is not very sensitive to immediate demand. Also, the international housing market literature emphasizes how little influence supply may have on price development (De Viers, and Boelhouwer 2005). DiPasquale and Wheaton (1994) have also indicated that the relationship between house price and new housing supply lead to weak analyses on the aggregate level because of a bad quality data on supply variables. Also, according to Shiller (2007): "*the increment to housing supply in any one year is necessarily tiny given the nature of construction technology, and the supply can be absorbed easily if expectations are still strengthening*" (p.36).

Thus, the development of aggregated house price is heavily influenced by demand factors.

The neo-classical theoretical framework forms efficient market hypothesis (for the theoretical description see appendix 5A). In the following, I shall apply some of the efficient market hypothesis assumptions for housing market.

Asset price reflects fundamentals

According to the efficient market hypothesis (EMH), developed by Fama (1970), the price of a financial asset reflects all available information that is relevant to its value, and the prices change as

new information become available to market. This information is determined from supply and demand factors and form fundamentals.

In fact, the difference between expected and unexpected change in the fundamentals has different affect on housing prices. Himmelberg, Mayer and Sinai (2005) stated that deterioration in underlying economic fundamentals, such as an *unexpected* future rise in real long-term interest rates or a decline in economic growth, could easily cause a fall in house prices, while *expected* change would not have much effect. According to EMH, this price adjusted the expectations before the change took place.

From the EMH perspective, changes in housing prices may reflect expected future movements in economic activity. From this point, macro-economic developments lead housing prices. There are many studies suggesting strong correlation between house prices and economic cycles. However, the correlation in some years may be weaker than in others (Goodhart and Hofmann, 2007), therefore, "*there is a rather close correlation…with house prices generally leading developments and the real economy*" (Goodhart and Hofmann, 2007, p.7).

Consequently, changes in the housing market may lead the economic activities. For instance, increased housing prices increase banks' asset side of balance sheet (via increased value of collateral) leading to increased credit supply and increased consumption (Adrian and Shin, 2008). Also, increased housing demand sparks construction activities and supply of new houses, resulting in increased employment in constructions, housing finance and real estate. According to Leamer (2007), "*Housing plays an extremely large role on the business cycle…and the business cycle would be less frequent and less severe if the housing cycle were less frequent and less severe"* (p.191). However, he correlates *housing volume* sales to economic activities rather than *housing price to business cycle*. Hence, the housing market leads the broader economy to the highest degree (Leamer, 2007; Goodhart and Hofmann, 2007).

Because of the correlation between housing prices and the real economy, there is a range of variables that might pose serial correlations between fundamentals and housing prices. A range of studies analyses the housing market by fundamentals and their importance in driving the housing market (see among others Rae and van den Noord, 2006; André, 2010; Girouard *et al.*, 2006a; Wagner, 2005; Himmelberg *et al.*, 2005). For example, Wagner (2005) has shown that 90 % of house price development from 1993 till 2005 (a nominal increase in housing prices of 153%) were explained by the underlying economic fundamentals, that drove housing prices up, especially *interest rates, income, the number of new house-owners and general price level in the economy* (see table in appendix 6A).

Efficient markets

Fama (1970) identified three forms of market efficiency: weak-form efficiency, semi-strong form efficiency and strong-form efficiency, which can be applied to housing market (see appendix 5 A for a theoretical explanation).

According to Case and Shiller (1989), the housing market is inefficient, because there is a proof that changes in prices tend to be followed by changes in the same direction in the subsequent year. This contradicts the EMH assumption that housing prices are forward-looking. Moreover, information about real interest rates does not appear to be incorporated in prices. And, overall, individual housing price changes are not very forecastable.

Additionally, Muellbauer and Murphy (2008) stated that expectations are often assumed, meaning that the information for valuation is neither persistently wrong nor fully efficient or "sensible". "*Because the information about housing is not perfect, the housing prices "overshoot" their fundamentals*" (Muellbauer and Murphy, 2008, p.27).

Risk- return correlation (the price should reflect the risk factors)

Another assumption of EMH is that the achieved/ expected returns have to be achieved on risk-adjusted basis; therefore the price should reflect the risk factors.

Potential housing downturn, negative equity and increase in price volatility are potential risk qualities. For example, the increased price volatility can be detected when housing prices are shifted from its long-run equilibrium. With increased housing price volatility it is expected that the prolonged house price increase will be followed by a housing downfall. When investing in housing, the investors/ buyers should therefore adjust their housing market exposure depending on their risk tolerance[5].

Rationality

Finally, under EMH assumptions it is expected that agents behave rationally- all behaviour is reduced to utility maximization, risk aversion, rational expectations (De Bondt, 2003). For example, with increased housing volatility (all other factors equal), households will increase their risk-aversion, leading to lower credit exposure (only risk-tolerant investor will accept high risk qualities of the financial market). Limited/ lower access to credit would result in lower demand for housing that in turn would stabilise housing prices. On the contrary, we experience a giant increase in credit supply and loosening credit standards, which, according to the OECD (2010), amplified price

[5] The implication is that a rational investor will not invest in a portfolio if another portfolio exists with a more favorable risk-expected return profile – i.e., if for that level of risk an alternative portfolio exists which has better expected returns (Elton *et al.*, 2003)

volatility, with real housing prices jump of 90 or more per cent in Australia, Belgium, Finland, Netherlands, New Zealand, Norway, Spain and the United Kingdom.

Critique of the theoretical approach

1) The credibility of the valuation models and efficient market theories are to be questioned: do they reflect all available market information that is relevant to its value? Do we really know the "real value" of housing? Is the information we obtain complete? The underlying uncertainties, according to Mishkin (2009) pose "valuation risk" to financial stability. "*The asset valuation posed greater uncertainty that would raise credit spreads, causing economic activity to contract further: The contraction in economic activity would then create more uncertainty, making the financial crisis worse, causing the economic activity to contract further and so on*" (p.4).

3) Moreover, the *quality of judgment* is often influenced by subjectivity (De Bondt, 2003). It is an especially difficult task in real estate valuation to go against the "mass" judgement. Excessive optimism, excessive use of popular models, excessive confidence, excessive rationalization and excessive agreement among analysts (herding behaviour) are the factors that influence the quality of judgment.

4) The EMH disregard transaction cost, which constitute up to about 10 % of housing prices (Lunde, 1997).

2) Fundamentals do not take into account other factors, which also affect housing prices, such as demographic changes, house building, credit conditions, and other asset prices level (Muellbauer and Murphy, 2008), as well as financial sectors developments. Nor do they include individual characteristics, such as size, foundation year, installations, and location. For example, the geographical location has a significant effect on housing prices, and this effect can fluctuate strongly (Wendt, 1994).

Also, other schools, approaches and models provide different variables for housing price formation. In appendix 6A, I have constructed a table in which I summarise the driving forces of housing prices.

To summarise, the correlation between housing price equilibrium and housing affordability is expected to be strong under neo-classical theoretical frameworks. The assumption proves true if buyers are rational. Current and expected income level should determine their house purchasing decision.

On the contrary, the theoretical assumptions do not reflect reality. The housing markets are not perfect markets, which, in fact makes a rational valuation difficult. Moreover, the other schools of economic theory (behavioural economics) pose different assumptions.

2.3.2 Housing price formation under behavioral finance assumptions

The understanding of housing prices development will not be complete without introducing the hypothesis of behavioural finance.

The behavioural finance view combines neo-classical economics with insights from psychology.

The blending of psychology and economy became popular in academic literature because "*conventional economics has failed to explain how asset prices are set*" (De Bondt, 2003, p.207).

So, behavioral finance assumptions explain why prices sometimes fluctuate widely, in the short-term, a fluctuation, which cannot be expected/ explained by EMH (see appendix 7A for some of the factors).

For example, the development of house prices has also been explained in terms of *speculative or psychological effects* (Shiller, 2005, 2007, 2008).

Hott (2009) includes *speculative bubbles, momentum trading and herding behaviour* into home price model and examine their influence on the development of prices. Lux (1995) developed a model demonstrating that increasing prices *enhance the sentiment* of investors with the result that the *optimistic investors* push the price even higher. Furthermore, *wishful thinking* (Shiller, 2009) affects housing purchase decision making and consequently housing prices. For example, *belief* in constant increase in housing prices was supported by *belief in a brighter future* (Shiller, 2005). In addition, these beliefs are influenced by "*memory, habit, social influence, emotion, visceral responses, and task complexity"* (De Bondt, 2003, p.207).

Consequently, it is not possible to explain housing price formation without "*psychological effects*"- housing purchase is not only an investment object (the assumptions of EMH applied to price *financial* asset), but also a commodity good. Therefore, it is more likely that housing purchasing behaviour will be influenced by emotions (in many cases it is a life- time investment). Greg Davis, a behavioural-finance expert at Barclays Wealth, describes the experience of buying a home as largely an emotional one, similar to that of buying art (*The Economist*, 2010a). People do not fall in love with governmental bonds. It's different for housing market. So, it is prevailing that the purchasing behaviour is based on emotions rather than rationality.

Thus, a reflection from behavioral finance assumptions contradicts the theoretical assumptions that housing prices should be explained by short-run demand-oriented variables. In the next sub-section, I outline the main expectations when both theoretical schools are combined.

2.3.3 Different theoretical assumption- different outcomes

Difference in theoretical approaches poses differences in methodological approaches.

Under Efficient Market Hypothesis assumptions, actual housing prices will reflect markets' fundamentals and can be explained by short-run demand oriented variables, such as income. It is

therefore expected that housing affordability (as a price-to-income relationship) influence long-run equilibrium on housing market. If the prospective (rational) buyers would find purchasing a home less affordable, this should in turn reduce demand and lead to downward pressure on house prices (Girouard *et al.*,2006a). Thus, it is expected that housing affordability should bring housing prices back to its long-term equilibrium. These assumptions are central in my study.

On the other hand, under behavioral finance assumptions, the opposite affect is expected.

"*When prices are rising, the consumer will want to act swiftly. In an expanding market, the sooner a decision is made, the sooner one can profit from capital gains. Such calculating behavior on the part of the home buyers will have the opposite effect when the prices are decreasing; the consumer will postpone the decision to buy as long as possible in order to avoid incurring a capital loss*" (De Viers and Boulhouwer, 2009, pp.21-22).

Thus, declined affordability (as a result of housing price increase) will increase housing demand, followed by further increase in housing prices. EMH eliminate this "noise" behavior, which is expected to be eliminated on the long run.

Depending on the underlying theory, different factors influence housing prices. Modern finance and behavioural finance are two competing schools and two different approaches to understand asset prices (Evans, 2003). On the other hand, both schools seem to assume a stable external reality and therefore an absolute truth. The problem lies in human cognition and perception of that external reality (Hansen, 2008).

Both theoretical explanations reflect degree of truth. For example, the markets are "rational" and the housing prices are also rational because the prices do reflect true economy, such as increase in GDP growth, income, and decrease in unemployment. However, as economy booms, investors become greedier. They buy assets to become rich very fast. Thus, a speculative boom surges and asset price increases. In the investors' beliefs, there are "rational" explanations in price formation. However, at some point rationality sparks over-optimism and over-trading. The whole market becomes irrational and the housing bubbles emerge.

To conclude, the assumptions of EMH and behavioural finance provide the following reasons to expect that "housing affordability" can be used as a method to study the imbalances on housing market:

- Demand-oriented factors shape housing prices (especially, income is important variable)
- Disequilibrium on housing market is to be eliminated on the long-term
- Disequilibrium on housing market is caused by irrationality, over-optimism and speculation and emotions among lenders and borrowers

- House prices are forward-looking; therefore, expectations are not based on historical price development.

The theoretical assumptions shape the conditions for a correlation between housing affordability and long-run housing prices equilibrium: the housing demand/price should be determined by affordability. In the following chapter, I shall extend the housing affordability concept by an overview of its further use. But first, I present the legal issues on housing affordability.

2.4 Legal issues on housing affordability

The legal document "Act on sales of real estate" (www.retsinformation.dk- Bekendtgørelse af lov om omsætning af fast ejendom) states that:

"The purchases and sales of real estate and other professional advice and assistance on sales of real estate should be based on advice on whether a buyer can afford to purchase a property. The advice must be persuasive to the appropriate review and assessment of known data on consumer income and spending. Officers (real estate agents) must indicate the gross and net expense pursuant to § 19 on the basis of a detailed budget. They must also indicate the cash price budget, which make purchasing property affordable, and what options consumers have to get a purchase financed" (§ 6).

According to the "Act on sales of real property", the real estate agent is obligated to calculate gross and net expenditure on the basis of a financing and prepare a sales presentation (in Danish, "Salgsopstilling") with the information about the property, which is necessary for a purchase decision (§ 17) (see an example of a sales presentation in appendix 8A).

According to the "Act on sales of real property", the main cost items are property price, financing cost, user-costs (electricity, etc), insurance, property tax, common expenditure ("fællesudgifter") for home owner-occupiers. Thus, the real estate agent is obligated to inform about relevant costs (the gross and net expenditure) for the first year (so-called first year payments) that should constitute the households' housing economy when buying a house.

Thus, legally binding, the housing purchase/advice should be based on the decision/calculation that a buyer can afford to purchase a property. This supports my underlying assumption that housing price levels are based on the assumption that they have to be affordable.

2.5 Housing affordability in practice

The concept of housing "affordability" is very popular in public discussions and with the real estate industry, perhaps because of its simplicity (Rae and van den Noord, 2006). In the following, I extend the study on housing affordability by analyzing its different use. Importantly, it reinforces the assumption that housing prices have to be in equilibrium with housing affordability.

2.5.1 Assessment of housing demand power

The mortgage credit institutions and real estate agents use the housing affordability approach to assess *first-time buyers'* ability to buy a house. It can be used on the aggregate level (for example, Girouard *et al.*, 2006a; Andre, 2010) and on the household level (see table 6. 50, p. 281 in Juul, 2006, also an example from Nordea in appendix 9A).

On the aggregate level, it can measure the percentage of households that can afford to purchase the median priced home (Stone, 2006) , Also, it evaluates the housing demand power: improved housing affordability should increase housing demand because more households can afford housing, this, in turn, should lead to upward pressure on housing prices. And the opposite effect is expected with the declined housing affordability (Girouard *et al.*, 2006a). Therefore, it is assumed that this variable seeks to bring house price back towards equilibrium. "*Prices and income are thus linked by a stable long- run relationship: they may drift apart temporarily, but they tend to return to their long- run equilibrium*" (De Vries and Boelhouwer**,** 2009, pp. 22-23). Therefore, the application of the price-to-income ratio (also as a measure of housing affordability) can also demonstrate whether housing markets are over- or under-valuated (Girouard *et al.*, 2006a; Case and Shiller, 2003).

On the micro level, it measures the level of affordable housing prices with a given level of income (Juul, 2006). Mortgage lenders and real estate agents assess the housing affordability by deriving the housing price level a potential buyer can afford with a given level of income (including savings, if any) less expenditures (Juul, 2006).

In the USA, the application of the housing affordability measure is more widely used than in Denmark (Nykredit, 2002). For example, the National Association of Realtors (www.realtor.org-affordability index) monthly publishes national and regional data on housing affordability index development. A high house price-to-income ratio indicates a general level of excess demand in housing markets and possible over-valuation.

In Denmark, a similar measure was first presented on the 25th of January, 2002 (Nykredit, 2002), as a Nykredit Regional Housing Index (in Danish, *boligbyrde* and can be directly translated as a "housing burden"). The index measures the total housing costs incl**.** financial cost in relation to income after taxes for an average family who buys a house or apartment for the first time**.**

The difference between an affordability index in the US and Nykredit's housing affordability index is that the Danish index includes all housing-related costs to measure housing affordability, while in the US only housing prices are used to measure the housing affordability.

Later I will discuss the relevance on housing-related costs to housing affordability. But for now, I conclude that Nykredit's affordability index might show real (actual) development in first time buyers' housing financial margin and therefore real potential power to buy a house. Including housing price only will not show other housing-related costs; therefore, housing affordability will be underestimated.

2.5.2 Housing market overvaluation

Studies (for example, Girouard *et al.*, 2006a; André, 2010; Himmelberg *et al*., 2005; de Vries and Boelhouwer**,** 2009), along with fundamentals, include housing price-to-income ratio (an indicator of housing affordability) as gauge of whether or not housing is within the reach of the average buyer. If this ratio rises above its long term average, it could be an indication that prices are overvalued. In that case, "*prospective buyers would find purchasing a home difficult, which in turn should reduce demand and lead to downward pressure on house prices*" (Girouard *et al.*, 2006a, p.127).

For example, a study by the OECD, used price-to-income ratio as a reliable indicator of a rising cost of obtaining housing to explain the 2005 high growth rates of house prices. Therefore, the ratio provided reasons to suspect overvaluation in many housing markets since 90's (Girouard *at al.*, 2006a). In 2010, the same study has shown that the ratio had declined since the housing bust, but has not yet reached its average level (André, 2010). Thus, it is expected that housing prices will fall further.

Himmelberg *et al*. (2005), applying price-to-income ratio, also demonstrated that prices in 2004 were "high", but there was little evidence of housing bubble in the studies of the US markets. However, they do not draw conclusions about house prices relying only on price-to-income ratio because "*without accounting for changes in real long-term interest rates, expected inflation, expected house price appreciation and taxes, one cannot accurately assess whether houses are reasonably priced*" (Himmelberg *et al*., 2005, p.90).

2.5.3 Housing affordability and housing counseling

Mortgage credit institutions use housing affordability measure as a tool in mortgage credit decision consultancy (Juul, 2006). It shows at what level of cash the customer in question could buy a real estate. On the contrary, an investigation by Juul (2006) has shown that the financial

institutions he examined, can come to widely different results in terms of what level of housing prices (or debt) households with the same level of income, can afford.

In order to investigate the use of housing affordability measures across mortgage institutions, Juul (2006) has shown that in counseling based on the same profile of the customer and the same economic information, institutions have come to widely different results in terms of affordable housing price level (see box 1, also table 6.50, p.281 in Juul, 2006).

Box1: Juuls' quantitative analysis

Henrik Juul (2006), for example, raised the dilemma on measuring affordability on national TV in 2005. In his TV program: "Panic on the real estate areas", sent on TV2 on the 21st of April 2005, he disposed a number of sequences proving that the area with the most frequent errors is real estate counselling in areas of housing affordability. The program, which was shot by hidden cameras, showed a number of interviews with various financial institutions, where a potential real estate owner is demanding counselling in connection with credit affordability.

The overall results of the real estate counselling are that an *unemployed* customer have received acknowledgement of debt from 4 different institutions ranging from DKK 528,534 to DKK 1,729,000- a difference of DKK 800, 466.

A counselling was based on the same customer profile, but financial institutions have come to different results.

One of the concerns was the omission of a number of budget entries or different treatment of these. For example, three institutions, out of six, did not include the cost of housing maintenance into the budget (which ranged from DKK 6. 000 to DKK 12.000 when included. Moreover, there was different treatment of other housing and non-housing related costs, which contributed to different level of income disposable and thus, different credit affordability.

In addition, misunderstanding of the housing affordability measure, and differences in how an institution evaluate a number of budget entries make the real estate's counseling on housing affordability as the area with the most frequent errors (Juul, 2006).

For example, the first case with the error was the case 212/1989 that concluded that a buyer could not afford a house she wanted to buy. However, the calculations were wrong, resulting in extra moving (and corresponding cost) to find another home. The customer won the case with the following cost compensation (Juul, 2006).

Another example is the case 464/1993, where allowance (rådighedsbeløbet) was estimated to be DKK 6,800 per month; however, the financial institution had forgotten to include mortgage debt service repayment when they calculated housing affordability. Inclusion of the mortgage debt service repayment makes the allowance at DKK 3, 600. (Juul, 2006) The level of mortgage payments is also important when calculating the level of affordable housing- it affects the level of future non- housing expenditure and thus, the ability to meet housing cost.

In his analysis, Jull has found that the real estate counseling to a noticeable extend has not taken into consideration that the customer's sum placed at his disposal after the purchase of a real estate is reduced by DKK 5, 600- 6,000 per month (Juul, 2006). Not including housing-related expenditure

into housing affordability calculation allows the customers/lenders to borrow/lend significantly more than the rules-of-thumb indicate (Juul, 2006). Because of lack of accuracy in measuring housing affordability, households can risk to buy more expensive housing than afforded, or banks to lend beyond the affordable level.

Thus, a housing-related counseling can be build around housing affordability. However, it has been mentioned above, this area is the area with the most frequent errors. The underlying reason for this is a different treatment of budget items that constitute housing affordability measure.

However, the investigation by Juul (2006) is not scientifically significant. First of all, the reliability of TV- shows are to be questioned. Also, the results are based on 4 institutions, which is not significant to derive any conclusions.

2.5.4 Regulation, stability and policies

National governments sometimes promote standards of housing affordability and housing quality across urban regions (Glaeser and Gyourko, 2008b). For example, national policies monitor housing affordability, address and improve the elasticity of the housing supply, promote affordable housing for low-income households, provide housing subsidies and address problems of social cohesion in order to decrease housing affordability problems (crisis).

According to Glaeser and Gyourko (2003) "a housing affordability "crisis" means that housing is expensive relative to its fundamental costs of production – not that potential residents are poor.

Unless there is a poverty problem- not a housing problem- housing prices are more likely to be the most important factor to housing affordability (Glaeser and Gyourko, 2003, 2008b). Thus, housing price affordability can be regulated by influencing housing prices as a first priority. For example, policy towards increased construction activities or decreased construction cost or even developing and maintaining a reliable database on housing supply (*e.g.* new construction starts, number of stock etc.) should decrease housing prices and housing affordability crisis (Glaeser, Gyourko, 2003, 2008). However, these policies change supply- oriented factors.

The example of the policy intervention into housing affordability regulation via demand-oriented factors can be found in the "Homeowner Affordability and Stability Plan" by the Obama Administration. In order to stabilize home prices for homeowners and to support a recovery in the housing market, the plan offers assistance to as many as 7 million to 9 million homeowners making an effort to continue on their mortgage payments (US Department of the Treasury, 2009). Firstly, the plan focuses on lowering mortgage payments as a share of income, mainly through interest rate reductions and term extensions for the borrower in default. Secondly, the principal can be reduced for those owing more than 115% of the property's current value (a reduction of 10% of the loan).

Third, jobless borrowers can get up to six months of payment assistance while they look for work (see also *The Economist*, 2010b).
However, this initiative involves a moral hazard problem: the borrowers may deliberately miss payments in order to get their loans adjusted.
So, the US example shows that the regulation of the housing market via housing affordability is possible, even though it involves a moral hazard problem.

To summarize, the concept of housing affordability is applicable for different state of affairs: regulation, housing stability, counseling, housing market valuation and housing demand assessment. Also, the overview of different use of housing affordability supports the assumption that changes in housing affordability affect housing prices developments.

In the following section, I shall present empirical findings on the relationship between housing prices and income (as a measure of housing affordability) and look upon whether it can express housing price equilibrium. In addition, empirical works on affordability measures are presented here.

2.6 Empirical evidence on housing affordability and house price equilibrium

Generally, the concern toward equilibrium between housing prices and fundamentals is one of the interesting questions in EMH. The long- run equilibrium is usually expressed as price-to-income ratio (De Vries and Boulhouwer, 2009, see also figure 14 in appendix 10A). Also, the same ratio expresses housing affordability. Therefore, I present empirical studies on price-to-income relationship and housing price equilibrium.
Theoretically, it is widely assumed that the house prices and income are linked by a stable long-run relationship; they may drift apart temporarily, but their tendency is to return to their long-run equilibrium (Gallin,2003). Therefore, empirical studies attempt to identify long-term equilibrium between house price and income, however, with different results (see appendix 10A).
First of all, it is widely assumed that housing prices are correlated to income level. Because income is one of the most important factors in households' economy (Chamberlin, 2009) and to a large extend determines purchasing power, it is an important variable in the housing price demand.
Thus, according to Fair (1972), "*the demand for an object or service is a function of income and the price of the object or service in relation to other prices. Per capita demand for housing services should thus be a function of per capita income and of the price of housing services relative to other prices*" (p.207). Therefore, some researchers assume that house prices and income are correlated.

Himmelberg *et al*., (2005) and Wagner (2005) also assess housing price development as a function of present income. Hott (2009) includes future aggregated income as well. Thus, positive increase in income increases the demand for housing and hence its prices (Miles, 1994).

However, it might not be a surprise if we observe a negative elasticity: "*The increase in income allows households to consume more, generating a negative covariance between the impact on housing prices and marginal utility*" (Miles, 1994, p23). However, he does not reject the likelihood of strong correlation between unemployment and housing prices (Miles, 1994).
Also, the OECD is sceptical of the price-to-income correlation because of its inefficiency (Girouard *et al.*, 2006a). Their empirical results on price-to-income correlation did not appear to be correlated to long-term relationship (they found the negative elasticity of real house price to real disposable income to be 1, 94 from 1970 till 2000). Consequently, OECD's studies estimated that housing prices' long-run equilibrium does not appear to be linked to the income, possibly because the cost of carrying a mortgage varies over time (Girouard *et al.*, 2006a). So, taking into account other variables (e.g. financing cost) might also affect long-run equilibrium (Girouard *et al.*, 2006a, see also appendix 19A). Also, there might be other drivers that might affect long-tern relationship (see appendix 6A).

Also Gallin (2003), of the Federal Reserve Board, suggests, that the co-integration between income and house price that is commonly found in the literature may be inappropriate. He suggested that the error-correction specification for house price and income, based on the price-to-income ratio, may be inappropriate: he does not find evidence to co-integration. However, he did mean that the level of fundamentals does not appear to be tied to the level of housing prices. He questions the validity of the associated error-correction models, which are based on long-run equilibrium in the price-to-income ratio.
Also Vries and Boelhouwer (2009), studying the Netherlands's housing market for the period from the first half of 1978 during the first half of 2008 (61 6-monthly observations) fail the income as an explanatory factor of the movement on the long run. In their previous studies Boelhouwer *et al*., (2004) arrived at a long-run equilibrium ratio of 23.2. They assume that a long-run *relationship between net interest payments and income* influences housing price developments. The *credit affordability* (I shall look closer at their findings in the credit affordability part) is a main driving factor for the long-run housing price equilibrium (Vries and Boelhouwer, 2009). According to authors, inclusion of the interest-to-income ratio instead of the

price-to-income ratio gives good statistical results. Their model takes into account the ability of low nominal interest rates since 2000 to support higher than average price-to-income ratios.

Also, according to Rae and van den Noord, the housing affordability approach is not particularly useful for assessing house price over-valuation, but it is a more useful measure of cash flow pressures (Rae, van den Noord, 2006) - it measures housing cost burdens development.

The findings on elasticity of real house price relative to real disposable income are presented in appendix 10A.

In terms of housing affordability measures, the empirical works mainly seek to add theoretical foundation to the argument to the superiority of the residual income approach versus ratio approach (Stone, 2006).

For example, the paper by Bramley (2010) seeks empirical validation or triangulation of traditional ratio-based affordability measures through the use of a range of survey data which highlight a number of these associated outcomes. Using household panel survey evidence he has shown that traditional affordability ratios (price-to-income) are still probably the best single measure, with residual income ratios used in a supporting role, because it derives the level of housing affordability threshold more precisely.

Stone (2006) argues that residual income approach is a more accurate measure of housing affordability because it highlights the interaction between incomes, housing costs and the costs of non- housing necessities. In spite of it, the ratio approach has been the prevailing approach in measuring housing affordability (Stone, 2006).

To conclude, the income determines housing purchasing demand, and consequently, housing prices. And mainly, empirical findings support the argument. Some empirical studies, however, found the price- to- income correlation to be weak, because other costs (for example, financing costs) have also an effect on housing prices. This is probably a reason why there is no theoretical recognition of the works on affordability.

In the following, I analyse how housing affordability has developed since 1993. In section 2.7, I focus upon housing prices in relation to income as an indicator of housing affordability development. In section 2.8, I focus upon housing-related expenditure as an indicator of housing affordability development.

2.7 An analysis of first-time buyers' housing affordability by applying price-to-income ratio

2.7.1 Housing prices and income development on an aggregate level

In the figure 2, I demonstrate the development in the housing prices index and gross national income index in real terms:

Figure 2 Housing Price and Income Development (Q1 1992=100), Denmark

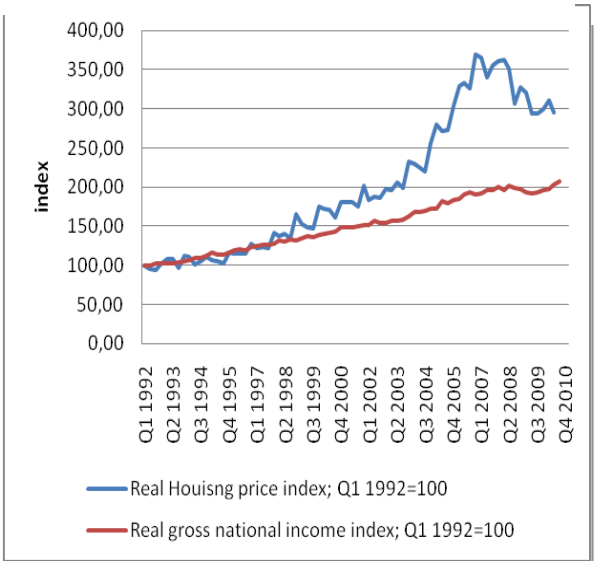
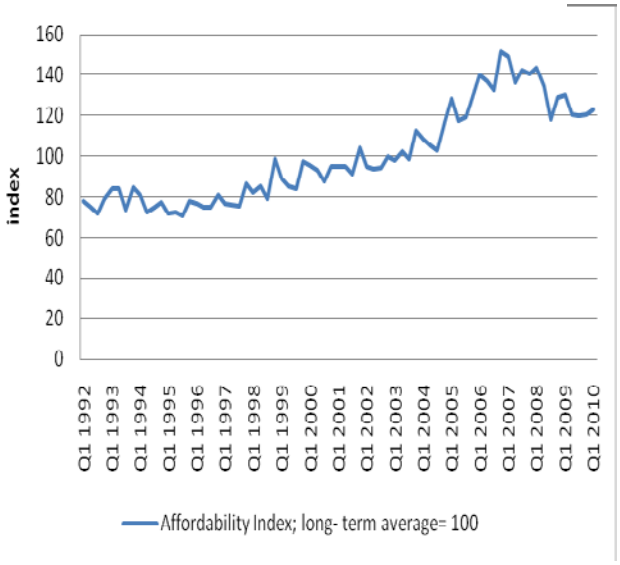


Figure 3: Affordability Index Development, Denmark



Source: Danmarks Statistics and own calculations

From 1992:Q1 till 1998:Q1, the development in housing prices was almost in parallel with the developments in income: the total increase in real housing prices was 34 per cent and total real gross national income increase by 27 per cent for a corresponding period. Since 1998, the gap in growth between income and housing prices has begun to increase. From figure 15 in appendix 11A, we can see that in 1998:Q1, the housing price growth was higher than income growth by "only" 7, 26 per cent. This gap continuously increased from 1998, and reached its peak in 2007. Thus, in 2007:Q1, the growth in housing prices was higher than the growth in gross national income by 50, 57 per cent. It is obvious that housing prices were not driven by income development.

In figure 3, I construct the price-to-income ratio for the period 1993:Q1- 2010:Q3. A value of 100 is corresponding to the long- term average of the ratio for the corresponding period. At the peak of the housing boom, the price-to-income index exceeded 150. Despite the resent housing prices fall, the price- to- income ratio is still above its long- term average.

In addition, in appendix 11 A, figure 16 , I demonstrate how the price- to- income index developed as a measure of housing affordability when defined in terms of the money households spend to buy reasonable housing (Arnold and Skaburskis, 1988). The fraction is based on real housing prices divided by real gross national income (and net disposable income) (for the data, see table 2 in appendix B). The increase in the index indicates the decline in housing affordability. The higher the index, the higher the proportion of income reserved to pay the housing price.
In 1992, the average house price level to aggregate income was higher by 350 per cent, a level, which was almost steady till 1998. However, at the housing peak years, the housing prices were higher than aggregate income by 700 per cent.
According to affordability development, I can see that more households will find housing purchasing less affordable. This should consequently have impacted on first time buyers' buying decision and have limited housing demand. However, the demand and the prices continued to increase even further in 2006.

To conclude, the housing affordability development indicates that first-time buyers' housing affordability declined significantly especially in 2003- 2006 (boom period). In 2007- 2009, housing affordability improved (bust period) due to a decline in housing prices, however, it still has not reached the trend we observed between 1992- 1998. *This is a first indicator of housing affordability development- since 1998, the housing price growth does not coincide with gross national income or net disposable income growth.*

The above analysis has provided valuable information on the evolution of the housing market. However, it contains some weaknesses. Thus, the aggregate income, the denominator of the index, reflects the gross level income for the whole population in Denmark. It does not differentiate the income of buyers/owner-occupiers, who are a "target" group for measuring housing affordability. The housing affordability for specific household types will be presented in the following.

2.7.2 Housing affordability across household types

In figures 4 and 5, I construct housing affordability across household types. Here, the price- income ratio is based on the median market price of a house/flat price divided by the median annual disposable and earned income for house/flat owner-occupiers (based on the data from "Investigation of Consumption", see also tables 5 and 6 in appendix B). The analysis represents housing affordability for modelized families.
Also, the distinction between earned income and disposable income is interesting. The gap between earned income and disposable income is very important in the housing affordability concept. The

increase in households' *disposable* income from one year to another indicates that there is a higher proportion of income to consume, or to pay for housing-related cost (for example, cost on a loan), leading to improved housing affordability, even if earned income is unchanged. Thus, the development in gap between earned and disposable income can also indicate how housing affordability has developed.

Figure 4 House owner-occupiers affordability

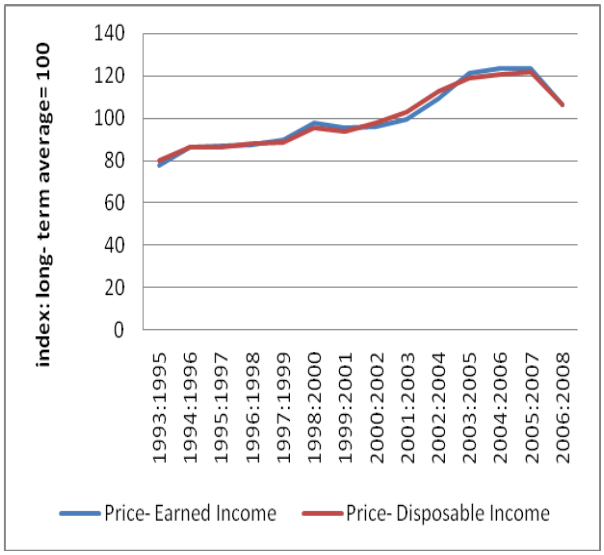
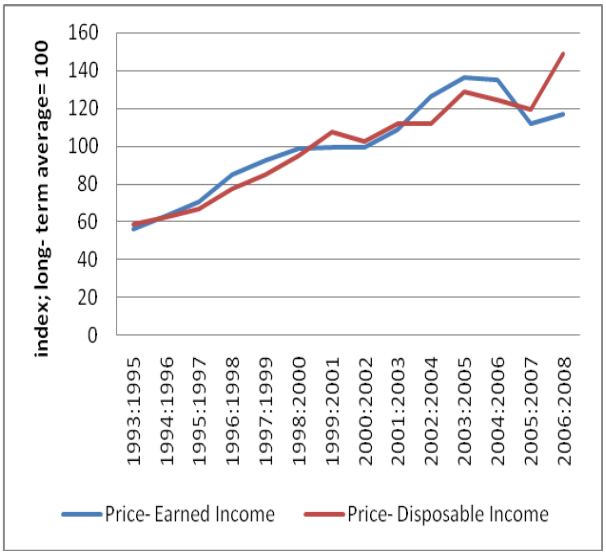


Figure 5 Flat owner-occupiers affordability



Source: Statistics Denmark and own calculations

According to figures 4 and 5, since 1997, flat owner-occupiers must pay higher proportion of income compared to house owner occupiers, while prior to 1998, there was an opposite trend. This is explained by higher increase in flat prices compared to house prices (for another illustrative presentation see tables 17, 18 appendix 12A).

In addition, the analysis on households' income for a corresponding dwelling type indicates that house owner-occupiers earn more (see figure 19 in appendix 12A). *This is a second indicator of imbalances in housing affordability: since 1997, flat owner-occupiers pay higher proportion of income compared to house owner-occupies because of higher housing price and lower income.*

(Here I disregard the sociological and psychological effects on increased demand for flats.)

In appendix 13 A, in table 2, figures 20, 21, I analyze more in depth housing affordability variables by growth ratios for flat and house owner-occupiers.

Generally, there was higher growth in housing prices compared to the growth in income. However, the developments, in general, are positively correlated.

Thus, the improvement in income disposable for flat owner-occupiers points to improved housing affordability in the median years 2001-2003 and after 2005 (can be also be seen in figure 5).

Therefore, it is a trigger for increased housing prices. The developments partly lead to an assumption that improved disposable income rather than earned income lead to increased housing demand.
In the years (1996-1999 and 2003-2004), housing price increase cannot be explained by higher growth in disposable income compared to earned income.
In bust times (2006-2008), a decline in earned and disposable income by 8, 93 and 26, 76 per cent correspondingly, reflected on declined housing affordability, as a result of income decline. Thus, the pressure on housing prices has already started in 2006. It might also explain the first decline in housing prices by 10, 78 per cent in the corresponding periods.

Thus, housing affordability for flat owner- occupiers and house owner- occupiers differs. Flat owner- occupiers pay higher proportion of income compared to house- owner occupiers.
Characteristics of location of dwellings have also an effect on affordability. How housing affordability developed across cities will be the topic for the next sub- chapter.

2.7.3 Housing affordability across regions

When I look at housing affordability across cities, house price development in the Copenhagen area, especially Frederiksberg, was characterized by higher increase in housing prices compared to other areas (see appendix 14A, figure 22). Here, of cause, limited supply of land and limited supply of housing affect the price equilibrium. However, taking income of corresponding areas into consideration, there is a big difference in housing affordability across cities (see figure 23 in appendix 14A). According to Shiller (2008) it is a "*perceived scarcity of urban centers*" effect on increased housing prices in urban areas. But, according to Shiller (2008), it is a myth that scarcity of urban/ metropolitan areas and unmet demand for it should boost housing prices in metropolitan areas. This demand can in fact be met- new urban centers, new towns or cities can be built from scratch when there is a demand. It requires only sustained and coordinated effort (Shiller, 2008). Therefore, the prices for a house in a big city should not be different from a price of a house in a smaller town. However, he assumes a supply side with high and swift elasticity, which is not a reality (or, at least, there is very limited possibility for doing it).
In addition to this, according to Ball (2007), it is not clear from a rational perspective, why house prices should rise in such places as Amsterdam, London and Madrid. I would like to add Copenhagen. Thus, the significant increase in Copenhagen/ Frederiksberg cannot be explained by increase in earnings. *This is a third indicator of imbalances in housing affordability development- the owner- occupiers in big cities pay higher proportion of income on housing compared to smaller cities' owner- occupiers.*

(Here I disregard the increased demand for housing in metropolitan areas because of sociological and psychological preferences, location to jobs, schools and day- care, as well as the lower supply of housing in capital centers. Only income level is assumed to affect the demand.)

Thus, the analysis of the evolution of housing prices by applying the housing affordability approach has indicated that the general level of housing prices was overvalued. Especially flat owner-occupiers have to pay higher proportion of income compared to house owner-occupiers. Also, big cities' owner-occupiers have poorer housing affordability compare to smaller towns' owner-occupiers. However, the analysis of affordability has some disadvantages.

2.7.4 Critique on price-to- income ratio as a measure of housing affordability

1) The price-to-income ratio disregards other variables that affect housing affordability. According to Yang and Shen (2008), housing affordability is: "*a subjective and complex concept than cannot be neatly or simply assessed by a single ratio of house price to income*". The concept reflects the households' decision process: "*it is a function of decisions that households choose to make between housing expenditures and non-housing goods*" (Yang and Shen, 2008, p.321).

In this view, "there are three critical dimensions of housing affordability*: income, non-housing demand and housing demand*" (Yang and Shen, 2008, p.318). Therefore, the cost of non-housing necessities, housing-related costs, financing costs should also be considered when measuring households' ability to buy a house (it will be the subject for chapter 2.8).

2) The average housing affordability index of value of 100 has been derived on the basis of long-term price-to-income ratio for the period 1992-2008. An average ratio, based on a longer time horizon may lead to different results.

3) The analysis on the aggregate level can lead to misleading results, because affordability problems among different households' demographics may have different consequences for housing market and financial stability. For the analysis on housing affordability across demographics, see appendix 18A.

4) The housing demand can be driven not only by the current and expected housing price level, but also by the past housing price development. This makes dubious the assumption that improved/declined housing affordability increases/decreases housing demand. I will discuss it in the following sub-chapter.

2.7.5 Reflections on the basis of behavioral finance assumptions

The demand for credit/housing is conditional upon perceptions of the current and future values of housing and of other goods (Miles, 1994). However, past housing price behaviour also influences the demand for credit and house. Case and Shiller (1989) show for instance that extrapolating behavior (backward looking expectations) is common in housing markets. During booms home buyers expect further housing prices rise and are worried about not being able to buy a house in the future market (Shiller, 2007). Accordingly, the backward-looking expectation influenced affordability assessment.

The developments in housing prices during boom times influenced peoples' perceptions and expectations. There were beliefs that housing prices will always be in surge, which in turn increased borrowing capacity. According to Akerlof and Shiller (2009), there were no rational arguments about investment possibilities. The only argument was that investment in real estate was a spectacular investment because prices will only go up. This strong intuitive and naive feeling was among people all over the world. The spread of this argument by mouth-to-mouth fed the boom during decades (Shiller, 2008).

The "money illusion" appeared to explain some of the impression that homes are spectacular investment. *"People compare home prices from the purchase time, however, they tend to forget to compare with other goods or even forget about inflation. However, the real value of the home may have only doubled over that interval, which would mean an annual appreciation of only about 1.5% a year" (*Shiller, 2008).

So, as prices go up, so does investors' confidence. According to Kindleberger and Aliber (2005), this confidence (the euphoric behavior) sparks asset prices even further because the eagerness to buy is stronger than the eagerness to sell.

It can therefore explain the fact that declined affordability (as a result of higher house price) sparks housing demand even further- people look at the historical house price increase and form the belief in constant house price increase. Thus, they rush to buy a house now because it might be less affordable in the future. This behaviour explains why housing prices are not correlated with the current income level and contradict my main assumption that changes in housing affordability should affect housing demand.

So far, the analysis of housing affordability was based on two variables, the income and housing price level. In the following section, I discuss how housing affordability should be defined not only in terms of income, but also in terms of *all* housing-related cost for existing home-owners. The analysis derives the historical level of housing-related costs. It is necessary to include these into housing affordability assessment because it demonstrates households' ability to sustain a house.

2.8 An analysis of housing affordability by including housing-related cost

According to the residual income approach on measuring housing affordability, the difference between housing cost and the residual income remaining after paying for required non- housing goods shows the housing affordability level (Stone, 2006). As stated by Yang and Shen, (2008): "*housing affordability should be measured as a household's ability to pay all housing costs without imposing constraints on living conditions*" (p.321).

Thus, a household can be considered having a housing affordability problem if disposable income after subtracting housing costs is too small for adequate living (Yang and Shong, 2009). Therefore, it is important to assess the amount a household can reasonably be expected to spend on housing-related cost and the amount that is left for its purchase of other needed goods and services (Arnold and Skaburskis, 1988).

In my analysis, I refer to housing-related costs, such as costs of maintenance and repair and transaction costs (the costs on mortgage is also important housing-related cost, however, it will be analysed in a separate chapter). I will derive historical development in housing expenditure patterns across different household types. These findings will contribute to my model on measuring housing affordability and projecting housing prices in Denmark (the last sub-question of the problem formulation). Prior to the analysis, I discuss why it is important to include housing- related cost into housing affordability measure.

2.8.1 The importance of housing-related cost to housing affordability

Real housing affordability

Applying price-to-income ratio only is not a sufficient metric to assess housing affordability (Girouard *et all*., 2006a) because it does not include all important variables that are important to consider when buying a house. *All housing-related costs* should contribute to a decision what households can afford (Nykredit, 2002) Thus, the cost of owning a house should be an important factor in housing buying decision.

Also, the housing affordability index from Nykredit represents the relationship between families income to housing-related costs (real property tax, instalments, interest rate payments, other housing-related cost) (Nykredit, 2002)

Nykredit's affordability index shows the real (actual) development in first-time buyers' housing burden and, therefore, their real potential power to acquire and sustain a house. Including housing price only will not show all housing-relateds cost to be afforded; therefore, housing affordability will be underestimated.

Also, according to The Danish Consumer Council (Fobrugerrådet), the assessment of the price and living costs of an apartment should also take into consideration transfer, tax, and costs of moving, renovation expenses, if any. In addition, before buying, the expenditure such as transportation from new home, expected living standards, furnishing, should also influence the housing purchase decision (www.boligejer.dk) (see also box 1 in appendix 14A).

Housing economy and households' financial soundness

Per Schutze (in Juul, 2004) in his article "Housing consultancy must be focused on the individual case"[6] stated: *We [mortgage- credit intuition] follow the customers economy in the years after housing purchase . . . we have a higher responsibility [to monitor whether] the private economy is well with the housing economy in the following years after housing purchase"(Juul, 2004, pp.191-192).* Accordingly, when new homeowners enter the housing market, new cost entries constitute their budget. Furthermore, the housing-related cost level influences the living conditions before and after the housing purchase. Also, it will influence the probability of default. It is therefore in the interest of mortgage credit institutions that a borrower is still financially sound after taking a loan.

Thus, the level of housing-related costs has importance to personal finance planning and personal housing economy, mortgage institutions and housing markets. For example, the inability to pay a mortgage costs (hypothetically, as a consequence of higher housing-related costs than expected) might lead to insolvency of households with the ensuing foreclosures and further pressure on the housing market.

Forward- looking approach

If one applies housing affordability, which is income and housing price dependant, one looks at a short period horizon. In terms of housing affordability, it is important to "afford" housing related-costs on the longer run. Thus, the inclusion of housing-related costs into the affordability measure transposes it from a *short time* measure into a *long time* perspective.

Besides, it is important in lending- borrowing relationships, because it decreases the risk of over-indebtedness and irrational lending.

So, including housing-related costs into affordability measures not only on the household level, but also on the aggregate level is important. It is the so-called "payment principle" in measuring housing affordability, which is used by real estate agents.

Therefore, I shall study the housing-related expenditure development during the 1993-2010 periods.

[6] "Boligrådgivning kræver en individuel rådgivning"

2.8.2 An analysis of housing-related costs development

The cost of maintenance and repair

First of all, I assess housing-related cost for existing home-owners against housing related cost for a renter. In appendix 15A, the figures 22, 23 demonstrate the "extra" cost of owing instead of renting. This amount measures the difference in sustaining housing- e.g. the cost of maintenance and repair (materials for repairs of dwellings, services of skilled craftsmen, miscellaneous maintenance).
The yearly difference between housing-related costs for house owner-occupiers and renters is significant. Thus, on average, the flat owner-occupier paid DKK 15. 000 per year more than a flat renter paid in housing-related costs. This significant difference demonstrates that this cost is important to include when measuring housing affordability/deciding to buy a house. From another side, decisions in the level of housing-related costs involve an important element of subjectivity (Yang and Shan, 2008). When buying a house, a household decide the level of housing and non-housing expenditures. Some households might choose to cut on other expenditure in order to afford housing-related cost, or just cut on housing- related cost by decreasing the quality and quantity of it.

Thus, the relationship between housing-related costs and disposable income is more appropriate when measuring housing affordability. The correlation between housing-related costs and corresponding income is a measure of "housing-related cost burden".

In appendix 15A, in table 1 and figures 24, 25, the reader can find the decomposition of housing-related cost as a share of total consumption, housing prices and income disposable across years and dwelling types.
When I look at housing consumption development across different dwelling types, the average housing-related costs as a percentage of disposable income is stable and constituted 5,57% for house owner- occupiers, 6% for flat owner-occupiers and 4, 96% for rented flats.
Disregarding the boom times, the owner-occupiers' housing-related costs were proportional to income, however the proportion is higher compared to what tenants pay for housing-related expenditure.

Here, it is interesting to observe that the housing boom contributed to increased level of housing-related costs (also as a proportion of income) significantly. Especially for flat owner-occupiers, the housing-related cost increased by 82% from 2005 till 2007. (It can be the evidence of equity withdrawal effect on increased housing consumption, such as renovation, Lunde, 2010). Moreover, this enormous growth cannot be explained by consumer price index growth in services for

maintenance and repair of the dwelling (see figure 27 in appendix 15A). It points to a conclusion that households increase the level of housing related services/ materials when house prices rise.

To conclude, housing-related costs when owing a flat are double compared to housing related-costs when renting. This significant difference demonstrates that this cost is important to include when measuring housing affordability/deciding to buy a home. However, the effect is not significant if income is expected to increase by the same proportion.
Thus, the expected payments on housing should be included in housing cost payments when measuring housing affordability. On average, the yearly housing-related-costs (here I focus only on the cost of maintenance and repair) corresponds to about 1 per cent of a market housing value. Thus, it is reasonable to expect that owners will pay ca. 1 per cent on maintenance and repair of a housing value per year, but not more than 6 per cent of income disposable.

Transaction cost and other costs

Buying and/or moving into a home costs much more than most types of transactions. Though, transaction costs often are overlooked (Lunde, 1997). Those include *estate agent's commission, advertising and marketing cost, legal fees, mortgage institution and bank charges, insurance and valuation cost, other taxes in relation with house purchase, moving cost, land transfer taxes, and deed registration fees* (Lunde, 1997).
Transaction costs for the seller typically range between 1.5 - 6% of the purchase price. In some countries in Continental Europe, transaction costs for both buyer and seller can range between 15 - 20%. (Wikipedia.org). In Denmark, according to Lunde (1997) recorded house prices are normally the actual purchase prices, which *include* transaction cost of approximately 10 % (for other results, see appendix 16A, figures 28, 29). According to Lunde (1997), there are no data on net price (the gross price less both sets of transaction cost). Thus, it is assumed that expenditures or service fees to the mortgage institution are included into registered price. In addition, some mortgage-credit institutes have announced that they will raise their administration fees for mortgage credit in 2010 (Danmarks Nationalbank, 2010). Moreover, differential price will be introduced for new mortgage-credit loans, meaning that the administration fee will be higher for adjustable-rate than for fixed-rate loans, reflecting the risks associated with the various loan types (Danmarks Nationalbank, 2010). Thus, it will be expected that buying a house with adjustable-rate loan will be more expensive compared to a purchase with fixed rate loans. From the financial stability perspective, the decrease in use of adjustable rate loans will limit losses on housing loans, write-downs and reduce interest rate exposure.

(For the total overview on a transaction cost items, corresponding amount and legal overview in Denmark, see appendix 12A.) The most important housing transaction costs are property value taxes and land taxes (ca. 2% of housing value) and insurance (ca.0,38% of housing value), which are to be included into the affordability measure.

2.8.3 Critique on including housing-related costs when measuring housing affordability

1) Which housing-related costs items (factors) might have bigger impact in housing demand/prices? From the modern finance perspective, the costs (factors) that bear more risks will have bigger effect on housing prices than those that are less risky.

For example, changes in interest rate will have a bigger impact on housing prices because this cost item cost bear more risk to households than the risk of increased cost of maintenance. In addition, in a case of increased maintenance cost, home-owners can go down with quality on a repair/ maintenance or they can prioritize projects or extend to better years. Therefore, the associated risk with this cost item is not significant. Therefore, there is the underlying uncertainty concerning the need in those expenditures on a household level (the level of a cost of a repair can be better than expected or, on the contrary, it can be worse than expected). It makes the affordability measure "stretched" and, therefore, dubious, if other housing-related costs (the cost of maintenance and repair) are included.

2) According to Stone (2006), it is housing standards that are important in a heterogeneous housing market and define the level of housing-related costs. So, if the housing standards are high in Denmark, will the housing-related costs also be expected to be high for home owner-occupiers? It is difficult to arrive at a consensus about housing standards in Denmark and how it should influence housing affordability.

3) Another problem with this approach is the mutually dependent effect. It is assumed that the housing prices are a function of housing-related costs (user-costs). On the contrary, the housing prices directly affect the housing-related costs. For example, according to Miles (1994), the housing prices influence the lending activities, reflecting on the mortgage rate.

4) A correlation between increased housing consumption and housing prices is also interesting. The value of housing can be increased because of improvements and maintenance. Therefore, it might be assumed that increase in housing prices will also lead to increased housing consumption (for an old house to be competitive on the market, one would need to spend on improvements if it's going to be sold). This might be one of the explanations of the increase in maintenance cost during housing boom times in Denmark. So, there might be different expectations in housing-related expenditures in different economic cycles.

Nevertheless, the most important argument for including potential housing-related costs into the affordability measure is that it will decrease the irrationality in lending and borrowing. Moreover, it will limit the likelihood of perceiving a house as a speculation object.

It is also in the interest of financial institutions that a customer is financially sound (or not in a burden problem) after entering the housing market. It will also reduce the level of forced sales, which are the threat to the housing as well as financial markets.

Thus, when measuring housing prices and housing affordability, it will be assumed that households spend 1% of housing prices on housing-related expenditure (repair and maintenance) and 2% on property and property values tax, 0, 38 % for insurance per year. It is further assumed that transaction costs to mortgage credit institutions are included into registered price.

2.9 Sub- conclusion on housing affordability

To measure the state of affordability for boom and bust periods, I had applied price- to-income ratio. I found that during housing boom times (2003-2006) housing affordability has declined significantly. The decomposition of the ratio had shown that the growth in housing prices can in a few years be explained by the growth in disposable income rather than earned income. The growth in disposable and earned income, on the other side, was not as strong as the growth in housing prices.

Between house and flat owner-occupation, house owner-occupiers pay a lower proportion of their income to buy an average house as a result of lower housing prices and higher disposable and earned income. I stressed it as an indicator of imbalances in housing affordability as there are no rational explanations why house owner-occupiers' affordability is better compared to flat owner-occupiers'. Moreover, there is also significant difference in average housing prices across regions whereas earnings do not fluctuate as much as housing prices. This is a third indicator of imbalance in housing affordability. During bust times (2006- 2008), housing affordability had improved, however, did not reach its average level.

I had applied the traditional measure of housing affordability. However, the prices are not the only important/relevant factors to measure housing affordability, as other housing-related costs should be included. Including other relevant cost items can improve the traditional measure of housing affordability. The so-called home-owner affordability (the ability to sustain a house) is important to housing stability, personal planning and financial stability. However, there is more elasticity in housing-related costs and they are more a subject to personal judgment, which makes it more difficult to foresee the level of housing-related costs when buying a house.

So far I disregarded the cost of debt and its affect on long-term housing equilibrium. In the following chapter I shall discuss the role of credit costs on long-term equilibrium. I stress the importance of credit costs to housing affordability.

3 Credit Affordability

In theory, the price of housing is correlated with the cost (interest rate) of underlying mortgage. Moreover, credit costs are the major cost in owing a house in Denmark (it does not exist while renting a house). Therefore, the second part of the project will be dedicated to credit affordability. How credit affordability influenced housing purchase decisions and lending activities will be analysed in more detail. First, I start the discussion how credit channel influence the housing prices.

3.1 Credits and housing prices

In the economy, where housing is financed by mortgage credit[7], availability of credit plays an important role in housing purchase decision. For the Danish housing market, mortgage credit plays important role, as most households finance their housing by credit[8] (Neuteboom, 2004).

Special attention in academic literature obtains the analysis of the relationship between credit availability and housing prices. For example, credit restrictions can block a household from the housing market. The more households with restricted access to credit market, the more housing will be available for sale, pushing housing prices downward.

On the other hand, credit expansions can contribute to inflated prices. For example, if buyers are "busy" to enter the housing market with limited amount of houses and unrestricted access to credit, it increases demand for housing, which in turn increases housing prices.

It is worth to mention that credit restriction and expansion affect housing prices on the short run. On the long run, in times of credit expansion, construction sector will react to increased housing demand by building new houses until the supply of housing equals demand. On the contrary, in times of credit restriction, when supply is high and demand is low, construction will be slow limiting housing supply on the long run. The equilibrium in lending activities and construction activities should bring housing prices back in equilibrium (DiPasquale and Weaton, 1996; Miles, 1994).

In the appendix, I make a representation of the yearly growth of the total lending vs. the yearly growth of housing prices in Denmark (see figure 37, appendix 20A) The first impression from the figure supports the argument that housing prices and lending activities in Denmark are correlated

[7] In the future, I will refer to mortgage lending as credit or loan. If other types of loan are meant, I will specify it.
[8] In Italy, only 50 per cent of owner-occupiers finance their housing by credit.

(the correlation of 0, 8)[9]. Correspondingly, the correlation proposes that the credit cycle coincided with the housing prices.

There are several theoretical perspectives/schools on explaining how the credit channel influences asset prices. Davis (1992) distinguishes the "financial fragility" approach among others[10], which I found the most applicable approach in the light of the recent events. Minsky (1977) and Kindleberger (1978) were the founders of the "financial fragility" approach. They emphasized the role of debt to housing booms and busts. Their theoretical frameworks will be presented in the following.

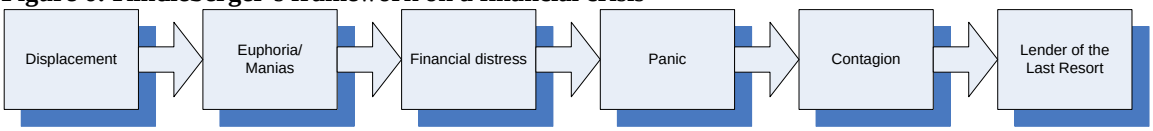
3.2 Theoretical evidence

Minsky (1977) and Kindlerberger (1978) considered the role of money and credit in determination of asset prices. According to theirs hypothesis, the expansion in credit can lead to boom and bust on housing market and subsequent financial crisis.

3.2.1 Kinderberger's framework

Kindlerberger (1978) stressed the importance of "displacement" and "euphoria" events as an initial factor that might lead to booms and busts. His framework can be modelled in the following way:

Figure 6: Kindleberger's framework on a financial crisis



Source: own creation

Prior to boom, there might be some "displacement events" that lead to credit expansion.

For instance, expansion of automobile production, financial liberalization, revolution in information technology, an unanticipated change in monetary policy, or some outside "positive" shock to the macroeconomic system. For the recent boom, financial *liberalization (deregulation), financial innovations* (Nesvetailova, 2007, Dore, 2008), *securitization* (Minsky, 2008), *new regulation rules, historically low interest rate* (Bordo, 2008), *shadow banking system* (Shiller, 2008) were pointed out as displacement events for the recent credit expansion and housing boom.

[9] However, the correlation does not prove that it is linearly correlated: other factors (GDP, unemployment, and interest rate) might have an influence on housing prices growth and lending growth.

[10] Other theoretical approaches are bank runs, financial regulations, the monetarist approach, rational expectations, uncertainty, credit rationing, asymmetric information and agency cost, and dynamics of dealer markets. These are the approaches to financial crisis, however, they can be transposed to understand asset price developments.

The displacement events provided new profitable investment opportunities. It created an investment boom financed by bank money. The displacement events then led to state of euphoria. The "euphoria" phase in the economy, a boom phase, is characterized by excessive borrowing, increased interest in investments and sparked asset prices even further. So, the main characteristic of euphoria is over-optimism. Over-optimism leads to *excessive risk taking*, to the belief that asset prices will always go up, and to a high degree of *speculative activity* among investors.

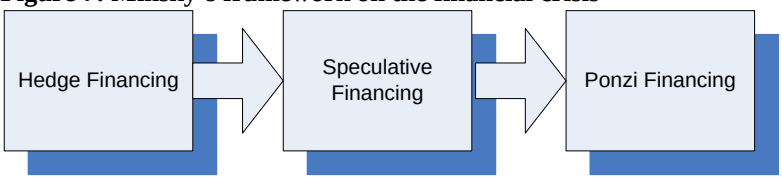
However, during the euphoria, investors have difficulty in distinguishing sound and unsound prospects (Bordo, 2008), which, in the future, increases the chances of defaults. At some point, the euphoria and mania can be distressed by some "negative" events (for example, the bankruptcy of Lehman Brothers in October 2008, resulting in a crisis worldwide). The negative events further lead to a panic, such as fire sale of assets and de-leveraging (Adrian and Shin, 2008), declining net worth, bankruptcies, bank failures. Because of the systemic risk, the turmoil spreads (the contagion effect) worldwide. Only The Lender of The Last Resort is expected to halt the contagion effect by supplying as much money as may be necessary to stabilise the market. Thus, the three capital injections (three bank rescue packages) in form of bank guarantees in Denmark were made to stop the panic. On 5th of October, 2008, the Danish Contingency Association concluded an agreement on financial stability (Bank Rescue Package 1) with the Danish Government, securing an unlimited guarantee to all depositors contributing up to DKK 35 billion (Danmarks Nationalbank, 2009). The Bank Rescue 2, of 3rd of February, 2009, injected app. DKK 75 billion to banking institutions and app. DKK 25 billion to mortgage-credit institutes. The Bank Rescue Package 3 was adopted in March 2010, aimed at amending the legislation relating to failing financial institutions in order to secure a fast and efficient liquidation.

3.2.2 Minsky's framework

Minsky (1997) stressed that pro-cyclicality in credit lead to asset price boom and bust. Thus, the supply of credit in good times and the decline in the supply of credit in less optimistic economic times result in asset prices fluctuations. Also, credit pro-cyclicality increases the likelihood of financial (housing) crisis (Minsky, 1977).

The pro- cyclicality in credits characterized by following states:

Figure 7: Minsky's framework on the financial crisis



Source: own creation

Hedge financing occurs when a firm's cash flows (from net operating profit) exceed cash flows commitments (interest rate payments) to serve debt over a long period. *Speculative financing* entails cash flow payments over a short period that exceeds cash flow receipts (interest rate payment). *Ponzi finance* occurs when a firm has interest rate payment higher than its net income[11].

A banker operates on the basis of expectations of cash flows (Minsky, 2008). Therefore, there is an increase in credit supply during hedge financing because of an improved profitability, and a decline during Ponzi financing because of a declined ability to collect interest payments of the underlying debt.

Therefore, in Hedge Financing stage, the credit supply increases, leading to increased demand for housing and an increase of the price, and there is the opposite affect in Ponzi Financing stage.

Also, academics discuss "credit" dynamics as one the most important variables in housing demand and therefore, housing prices. Some of the empirical findings will be presented in the following.

3.2.3 Empirical evidence and other studies on bank credit and property prices

There are several variables of credit dynamics that might have some effect on housing prices. Some of the dynamics are presented here: credit conditions, development of interest rate and credit growth.

Muellbauer and Murphy (2008) stress that credit *availability* is one of the main demand-driven factors, (together with income, housing stock, demography, interest rate and lagged appreciation). When credits are more available to households, there will be more incentive to enter the housing market. Therefore, the growth in credit leads to a growth in demand for housing and, thus, to higher prices.

A study by de Greef and Haas (2000) documented that the amount of mortgage credit measured not only by its price (interest rate), but also by its *volume*, reflected the excess in housing and credit demand in Netherland in the period between 1993 and 1999. They found that there is a positive correlation between the level of outstanding mortgage debt as a percentage of GDP and housing prices. Their findings show that 88 per cent of house price increase can be explained by growth in mortgage lending for the corresponding period.

[11] Please note, that Ponzi finance is not the same as Ponzi schemes/pyramid. The former term describe the relationship between the operating income and the debt service payments of individual borrowers, which is affected by the level of indebtedness, interest rate. The latter term involves promises to pay an interest rate of 30 or 50 per cent a month, however, it requires new depositor every month in order to keep this promise. The common feature in these definitions is a need of new capital injection in order to keep up with high interest payments. However, operating on Ponzi Financing stage is legal, while on Ponzi pyramid is not.

Miles (1994) also emphasized the importance of the households' credit channel to housing market, and therefore, to the housing prices and the level of owner-occupation. However, he stressed the effect of changing *credit conditions* allied with more optimistic expectations of future income as factors contributing to the increased demand for housing. Thus, relaxed credit standards result in higher prices, while tightened credit standards result in lower prices. The evidence was based on observing that countries with lower credit availability (for example, Germany) experienced lower housing price fluctuations.

Another important characteristic of credits is *interest charges*, as a function of interest (mortgage rate) and the amount borrowed and the term of agreement (Finlay, 2009). A range of empirical studies demonstrated the correlation between interest rate and housing prices. The studies are presented in appendix 19A.

Thus, studies concluded that credit growth, its cost and conditions are important variables that determine housing prices. Therefore, credit expansions (credit boom) lead to housing booms.

From another side, housing price increase may lead to increased credit demand. A study by Goodhard and Hofmann (2007) measured how housing prices (housing wealth) affected the credit demand for 16 industrialized countries over the period 1980 till 1998 using quarterly data. They found that property prices appear to be an important determinant of the long-run borrowing capacity of the private sector (because borrowing capacity is a function of their collateralizable net worth). Therefore, property prices might explain the long-run movements of bank lending. Thus, housing booms lead to credit booms.

According to Goodhard and Hofmann (2007), "*This potential two- way causality between bank lending and property prices may give rise to mutually reinforcing cycles in credit and property markets*" (p.148).

In addition, the credit boom and bust are not new to history. Norway, Finland and Sweden also experienced such real estate boom. The underlying causes of those booms were massive credit availability driven by irrational expectations (Allen and Gale, 2009). The Japanese bubble in real estate and stock markets in 80's and 90's provides a good example when expansion in credit leads to a bubble, which caused severe financial distress (see Goodhard and Hofmann, 2007, p.98; Kindleberger, pp.126-135; Allen and Gale, p.380).

Thus, during the boom times, there was evidence (both, theoretical and empirical) of a coming financial and housing instability, as were stressed by Kindleberger (2005) and Minsky (1982). However, as was stated by *the Economist* (2009), Minsky's hypothesis was neglected by the regulators and by markets, and the economy is now paying the price. So, a relationship of credit and

prices is not new, "*a critical determinant of asset prices is, thus, the amount of credit that is provided*" (Allen and Gale, 2007, p. 237).

In the following, I analyze credit dynamics in Denmark, represented by legal rules on mortgage lending (3.3.1), credit policies (3.3.2), credit growth (3.3.3), credit supply conditions (3.3.4) and the underlying risks (3.3.5) as a background to understand the credit affordability concept.

3.3 Credit dynamics in Denmark

Regulations can affect the balance sheet structure of lenders, their funding policy, they can influence the quantity and price of credit available to finance house purchases (Miles, 1994).

In this sub-section, I present the current regulation laws.

3.3.1 The Regulation of Mortgage Lending in Denmark

Mortgage-Credit Loans and Mortgage-Credit Bonds Act

In Denmark, the mortgage credit loans provided on the basis of the rules on mortgage lending defined by the "Mortgage-Credit Loans and Mortgage-Credit Bonds Act" (see www.retsinformation.dk; www.finansetilsynet.dk - Bekendtgørelse af lov om realkreditlån og realkreditobligationer m.v.)[12].

Mortgage-credit loans shall be granted against registered mortgages in real property according to the following rules:[13]

Box 2 Extract from the "Mortgage- Credit Loans and Mortgage- Credit Bonds Act"

- **§ 3** The maximum term of the loan shall be 30 years
- **§ 5** Loans to Owner-occupied all-year residences should be granted within a lending limit of 80 per cent of the value of the property (loan- to- Value(LTV)
- **§ 10** The mortgage-credit institution shall set an estimated value on the real property to be used for the loan authorisation. Said value shall fall within the amount that an experienced buyer with knowledge about price conditions and market conditions for the relevant type of real property would be deemed to be willing to pay for said property (market value). Conditions which occasion a particularly high price shall not be taken into consideration during valuation.
- **§ 10,** *Stk. 3.* The mortgage-credit institution shall in its valuation take into account any risk of changes in market conditions or structural conditions.
- The loan may solely be funded through the issuance of bonds. This means that the mortgage bank does not have access to raise finance in the money market to fund its mortgage lending.
- **§ 18.** Mortgage-credit institutions authorised to conduct mortgage-credit business in Denmark shall hold exclusive rights to issue mortgage-credit bonds in Denmark
- **§ 18,** *Stk. 2.* The issuance of bonds by the mortgage banks is subjected to a balance principle. The balance principle ensures that the mortgage bank does not assume significant risk in connection with its mortgage lending activities and the funding of the loans. This is true for interest rate risk, liquidity risk, currency risk etc.

[12] Act No. 454 of 10 June 2003, with the changes imposed by § 105 of Act No. 90 of 31 January 2007 and § 2 of Law No. 577 of 6 June 2007.

[13] Here I provide only main rules. For the details and exceptions see www.financetilsynet.dk

The bond holders have a preferential status in the event of the bankruptcy of a mortgage bank. However, there has never been a bankruptcy in the more than 200 year long history of Danish mortgage credit (www.realkreditraadet.dk-Danish Mortgage Model).

The main reason for the "security" is a backbone of the Danish mortgage credit system, a *balance principle*, which is also a guarantee of the model's unique properties. The balance principle means that there is a close match between the bonds and the mortgage loans issued (RO Mortgage Bond) (www. Realkreditraadet-Danish Mortgage Model).

However, a new Danish Covered Bond legislation came into force on the 1st of July 2007, and, in many ways, it changed the conditions for financing real property in Denmark. I will overview this legislation in the following sub-section.

Danish Covered Bond legislation (SDO legislation)

The SDO (Særligt dækkede obligationer) legislation (www.retsinformation.dk- "Lov om ændring af lov om finansiel virksomhed og forskellige andre love"; www.realkreditraadet.dk – "Covered Bond Legislation") has changed the balance principle in the Danish mortgage banking system. It is now possible for issuers to choose between a general and a specific balance principle. Before the new legislation, there was only the general balance principle (see appendix 21A for more information the on general and the specific balance principle).

Thus, with the introduction of the new covered bonds, Danish mortgage banks may today choose from three types of bonds to fund their loans: the traditional mortgage bond (RO), the covered mortgage bond (SDRO) and the covered bond (SDO).

The principal elements of Danish Covered Bond legislation appear from the following extract:

Box 3 Extract from the Danish Covered Bond legislation

- Two new bond types: Covered bonds (særligt dækkede obligationer – SDOs) and covered mortgage bonds (særligt dækkede realkreditobligationer – SDROs). **§ 16 a**
- Commercial banks may now fund their lending against mortgages on real property by issuing covered bonds. **§ 16 b**
- Both mortgage banks and commercial banks may grant loans without any restrictions on the loan term and repayment profile, if they are funded by covered bonds (or covered mortgage bonds as regards mortgage banks). **§ 33**
- Mortgage banks and commercial banks must ensure that the LTV (loan-to-value) limits are observed throughout the term of each loan funded by covered bonds or covered mortgage bonds.
- Mortgage banks and commercial banks issuing covered bonds or covered mortgage bonds may issue a new type of bond, junior covered bonds, to obtain capital for supplementary security to ensure compliance with LTV limits.
- A new balance principle makes it possible to segregate the loan and the underlying bonds completely.
- A rule that loans not directly linked to listed bonds may be prepaid at a price of 100 (par). This rule is called the par rule.

Both commercial banks and mortgage banks may issue covered bonds, but only mortgage banks may issue covered mortgage bonds and mortgage bonds. In practice, there is no essential difference between the two types of covered bond. Also the mortgage banks have – with no exception – chosen to continue with the match funding between mortgage credit lending and bond issuance (ww.realkreditraadet.dk- Covered Bond Legislation).

In the following, I overview the credit conditions in Denmark.

3.3.2 Credit policies in Denmark through boom and bust periods

Generally, banking activities fluctuate with the economy. In the upswing, lending often increases and the opposite effect is observed in recession. As a result, banks' activities and the lending policies are seen to be correlated with the economy cycle.

Credit policies in boom times

According to the Financial Stability Report from 2005 (Danmarks Nationalbank, 2005), the households' financial situation was defined to be sound. "*The economic conditions of the households have improved. Real incomes have risen, and more households have a sound income concurrently with the fact that unemployment has fallen. The prices of owner-occupied housing have risen significantly in recent years"* (Danmarks Nationalbank, 2005, p. 48) increasing households' wealth. Therefore, because of a strong economy, there were no prospects of a significant general fall in housing prices. These favorable conditions and the growth in housing prices have contributed to a relax of lending standards.

In addition, the historically low interest rate contributed to a declaration stating that the development in the households' interest-rate exposure posed no threat to the functioning of the financial system or to financial stability (Danmarks Nationalbank, 2006).

Also, the favorable economic conditions had contributed to high banks' returns, lower level of write- downs, improved ability to meet payment obligations, historically low number of enforced sales and low risk assessment (Danmarks Nationalbank, 2006). These factors have also contributed to reasons to relax lending standards.

Thus, the over-optimistic assessment of economic and housing market conditions have contributed to the deterioration of credit standards (Danmarks Nationalbank, 2006).

The relaxation of lending standards can also happen by means of simplified application forms. For example, in the US, the consumption expenditures were not asked when granting a loan (Finlay, 2006). According to Finlay's research, out of 30 different credit products applications, 12 asked no questions whatsoever regarding expenditure (Finlay, 2006), because lenders are under competitive

pressure to keep application forms short- and, the longer the application form, the less likely the applicant is to complete it (Thomas, 2000). Moreover, simplifying the credit granting decision leads to lower mortgage origination cost.

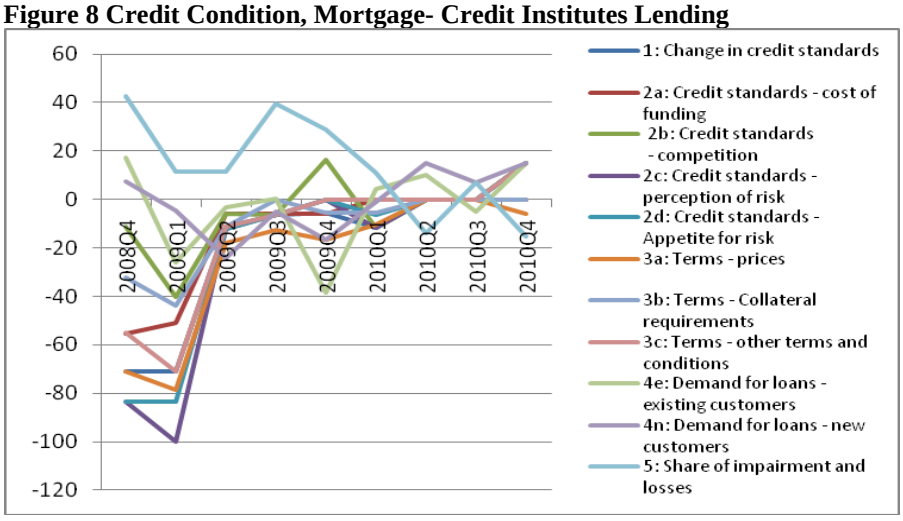
Thus, the potential explanation for the persistent cycle in bank lending observed in the past are relaxed credit standards (Goodhard and Hofmann 2007).

Credit policies in bust time

According to Danmarks Nationalbank's lending survey[14](Danmarks Nationalbank, 2010c) on credit policies, the bust on the housing market influenced banks' risk assessment, appetite for risk, competition behavior, cost of funding. These are the general factors behind changes in credit policies (see figure 8 and explanations on methodology applied in appendix 22A).

Thus, during the 4th quarter of 2008, the banks have tightened credit policy by lending to private households through higher prices, requirements for collateral and loan to value ratios. Mortgage banks have not changed their contribution rates, but instead tightened credit policy by tightening the requirements for collateral, available funds, liability and loan maturity. The development in credit policies is illustrated in figure 8.

Figure 8 Credit Condition, Mortgage- Credit Institutes Lending



Source: Danmarks Nationalbank (Nationalbankens udlånsundersøgelse 2008Q4- 2010Q4)) and own creation

Tightening in credit policies entails lower access to credit during the bust time. This results in lower credit demand, and consequently, lower housing demand/price.

3.3.3 Total and Mortgage Lending Growth

During the last boom and bust period, most industrial countries experienced episodes of boom and bust in credit markets (Goodhard and Hofmann, 2007). Danish owner-occupiers were more

[14] The first study was conducted by 4th quarter 2008, therefore, there is no corresponding survey during housing boom times (the survey is available only in Danish, see Nationalbankens udlånsundersøgelse)

indebted than ever before as the net liability/income ratio was at an all-time high already in 2005 (Lunde, 2007b). The median owner- occupier family had a debt (net liability), which amounted to 214 % of their income in 2005 (Lunde, 2007b). Also, Denmark obtained a leading position in terms of the level of debt per person, per GDP and per income disposable among other European countries (Lunde, 2008b; Hansen *et al.*, 2009) (see also appendix 20, figures 42, 45 for illustration).

Thus, for the period 1993:Q1-2008:Q4, the total banks' lending increased by 327%, the mortgage credit lending to owner-occupied sectors had increased by 223 % in nominal terms (see corresponding figures in appendix 20A, figures 38, 44 and tables 7, 8 for the data in appendix B).

Furthermore, the mortgage market has grown bigger than the Danish economy. Thus, mortgage lending, as a percentage of GDP has increased from 176 per cent in 1993 till over 300 per cent in 2010 in nominal terms (see figures 37, 40 in appendix 20A). The debt level in relation to income (the debt burden) has also doubled from 180 per cent in 1993 till 311 per cent in 2010 in nominal terms (see figure 39 in appendix 20A and table 9 in appendix B).

The increase in indebtedness was explained by improved ability to make payments, increased housing prices, easier access to credit, and improvements in credit granting decision, as well as lower level of unemployment and generally favourable economic conditions. Nevertheless, the debt burden (debt-to-income) increased, making households more vulnerable to default if interest rates rise or housing prices fall (Girouard, Kennedy and André, 2006b).

The improvements from the supply side conditions on credit markets were believed to "trade- off" the increased risks from demand side conditions (Girouard *et al.*, 2006b; André, 2010; Lunde *et al.*, 2008a).

3.3.4 Credit-supply conditions

Wider capital market regulations, technological change and reductions in the cost of information technology, developments in the sharing of information on credit histories, and the deepening of markets for securitized contracts and derivatives, new types of mortgage contracts (Muellbauer, 2008), improved credit scoring systems (Avery, 2009; Green and Wachter, 2007), easer access to mortgages, improved mortgage system, relaxation in mortgage restriction, longer loan terms, lower payments (Lunde, 2008b), credit liberalization, financial innovation (Nesvetailova, 2007), these are some of the explanatory factors of improved access to credit. They all shaped improved credit supply conditions leading to credit expansion. That is to say, the developments of the credit supply conditions made credits cheaper and more affordable.

In addition, changed dynamics within housing finance market in Denmark are believed to have significant effect on the households' ability to service the debt burden. For example, the introduction of *adjustable interest rate mortgages* (ARM) in 1996 and of *interest-only* mortgages (IO) in 2003 made it possible for owner-occupiers to reduce payments considerably when re-mortgaging (Lunde, 2007b).

The market share of ARMs has risen quickly after 2000, especially in periods when interest rates were falling from 2003 to 2005. In 2000, only 6% of the total mortgage value was ARM, while 83% were fixed-rate mortgages (FRM). In 2006, the share of ARMs had risen to 50%, while the share of FRMs had shrunk to 45% (see appendix 23 A and table 11 in appendix B). Thus, the mortgage developments had positively affected households' cost payments when new choices were introduced. It contributed to a perception that: "*In Denmark, while mortgage debt burden has been rising, the ability to service that debt has either been relatively stable or has improved slightly*" (Girouard *et al.*, 2006a, p.130).

Also, the option of repayment provided new flexibility for home occupiers. With the option of repayment, households cut their interest payments.

In addition, *improved credit scoring systems* made credit granting decisions more efficient.

In the US, the automation of many of the steps in the lending process resulted in a decrease of the cost of originating a mortgage lending from 2, 5% to 1, 5 % (Benett, 2001, in Maullbauer, 2008)

Avery, Brevoort and Canner (2009), and a group of researchers for the Federal Reserve System Board analyzed how credit scoring contributed to improved credit affordability. They concluded that the credit scoring system had increased the availability and affordability of credit thanks to new and improved methods of establishing prices on credit (Avery, 2009), which, according to Green and Wachter (2007) lead to an acceleration of the sub-prime market.

Thus, the contribution from financial sector developments resulted in easier credits- both globally and in Denmark- which attracted more first-time buyers. The growing appetite for credits has raised households' debt level, contributing to further house price appreciation (Muellbauer, 2008). However, as prices, debt level and financial innovation had grown, so did the risks. The growth in credit (indebtedness) posed higher risk than ever before (Case and Quigly, 2008; Lunde *et al.*, 2008a; Ynesta, 2008). Also, the rise in ARM is associated with increased risk exposure and housing boom. So, despite the housing tangible value, the investment in housing is not as safe as it was believed. The associated risk from housing markets will be presented in the following.

3.3.5 Risks

In boom times, the financial markets were characterized by ample liquidity, low risk premiums and positive economic developments (Danmarks Nationalbank, 2008). However, a range of risk factors were under-estimated, or even neglected.

First of all, the risks of housing to wider economy were neglected- the *risk of housing downturn* was under-estimated or even rejected. For example, Danmarks Nationalbank's assessment of financial stability in 2007 stated that even on the housing downturn, there were no immediate risks to financial stability and wider economy. "*There is no reason to expect a general housing price dive for as long as the economy remains strong*" (Danmarks Nationalbank, 2007, p.6). Also, some economists stated that if there were a housing downturn, it should be a "soft landing" because the increase in interest rate was expected to be relatively mild (Rae and van den Noord, 2006). Also, a prevailing belief among people that "this time is different" resulted in risk misunderstanding (Reinhart and Rogoff, 2009).

However, because the significance of the housing market to the wider economy is so substantial (Leamer, 2007; Goodhart, Hofmann, 2007), the risk of a housing downturn can be harmful to construction, financial and real estate sectors.

Secondly, another very important risk to financial stability and housing market was neglected: the *risk of over-indebtedness*. Already in 2005, in Denmark, 6% of all households from a survey were in a *burden problem of housing-related cost,* of whom 10% were households with a main income earner of 25-29-year-old, 8%- single persons with children (see appendix 24A and 25 A for the analysis and figures).

The involvement of an "enormous" debt in housing makes housing investment dangerous. When housing prices fall, many owners are pushed into negative equity, which makes households reluctant to sell their property, or move to another place of living in order to get a new job.

This also exacerbates the problem of unemployment.

Thus, the effect *of negative equity risk* on economy was also under-estimated.

The adjustable- rate (ARM) and interest only loans (OIM) seemed to decrease households' interest payments- the ability to service the debt thus improved. However, the increase in ARM and decline in FMR may in itself pose a risk if the interest rate suddenly increases and if those mortgage holders face a tight budget situation. Therefore, the increased proportion of IOM and ARM is associated with higher risks (Lunde, 2008c). In addition, the high proportion of "risky" ARM and IOM is compared to American subprime loans (Lunde, 2008c), which is associated with irrational subprime

lending (Mortensen and Seabrook, 2008). However, *the risk of interest rate* increase was under-estimated under the assumption that interest rate increase was expected to be mild (Rae, van den Noord, 2006).

Furthermore, the increased ability of households to extract or borrow against their home equity has altered consumer spending (Muellbauer, 2008) and created more indebtedness (Lunde, 2010). It increases further the *possibility of a default* (here increased spending and indebtedness are associated with higher credit risk, if income and other factors are constant).

In addition, the volatility in lending activities since 1993 has increased (see in figure 43 in appendix 20A). Volatility in mortgage lending increases housing volatility and economic cycles, which in turn, can sometimes trigger financial instability.

So, the combination of all above mentioned risks makes households and economy more vulnerable if housing prices fall or interest rates rise. Increased households' vulnerability to default means that the possibility of not being able to repay a loan is increased in spite of increased earnings and decreased interest payment.

Under rational lending, this means that improvements in credit conditions (liberalization, easier access to mortgages, new types of loans with lower mortgage payments) should have been neutralized by higher risk perceptions. So to say, because of increased volatility/pro-cyclicality on housing and credit markets, banks should have diminished the lending activities.
However, in reality we experienced the opposite: as housing price deviated from its long term equilibrium, the credit demand and supply growth continued (measured by total lending on the balance sheets of Danish banks), reaching its peak in 2006.

Only in 2008, after the collapse of Lehman Brothers, the decline in lending activities had begun. However, this decline was explained by increased business uncertainty. It has become more difficult for banks to valuate profitable projects (Danmarks Nationabank, 2007). Therefore, banks cut on lending and households cut on borrowing. This happened when housing price already were declining. However, when banks cut on corporate and household lending and tighten credit standards in a *crisis* period, this poses even greater risk to a wider economy, and to a housing market.

To conclude, lending was based on general favourable economic conditions for households. However, taking risks factors into account, the households' risk exposure (measured by debt-to-income; debt-to-GDP and increased volume of IO mortgages) increased as well, making them more vulnerable to default. Also, because housing prices were far away from equilibrium, the risk of price decline, housing wealth loss, negative equity and foreclosures increased significantly.
So, can those imbalances be explained by an improved ability to service the loan? I address this issue by the credit affordability concept in the following section.

3.4 What is credit affordability? - Concept definition based on literature overview

I study the concept of credit affordability by raising the following questions:

- What is credit affordability?
- What is the right measure of credit affordability?
- How did credit affordability develop through the recent housing boom and bust?

3.4.1 Credit affordability definition

In the UK, a report made by the Task Force (Consumer Affairs Directorate, 2001) stated that, with the exception of the Office of Fair Trading 1989 (OFT) report on over-indebtedness and the Policy Studies Institute (PSI) report in 1992 on credit and debt (Berthoud and Kempson, 1992), there has been relatively little research on the extent and nature of over-indebtedness and irrational lending. One of the possible reasons is that there is no generally accepted definition of over-indebtedness and affordability, and this poses further challenges in its measuring. Therefore, there is a need for a detailed research study to build up a better understanding of the factors that lead consumers to become over-indebted.
In their report on tackling the over-indebtedness, the Task Force examine the nature and extent of consumer debt and its affordability (Consumer Affairs Directorate, 2001, 2003). They explain the credit affordability concept as follows*:"when income is sufficient to cover reasonable living expenses and meet financial commitments as they become due" (*Consumer Affairs Directorate, 2001, p.3).
According to Finlay's (2006) article, deriving a model on credit affordability, it should represent the amount available to afford credit and measured as "*the amount of disposable income available after regular household expenditure and existing credit commitments*" (Finlay, 2006, p.655).
In the Financial Services Authority's (2010) report on responsible lending, the affordability concept is defined*: "mortgage is affordable if its level and term allow the consumer to meet*

current and future payment obligations in full, without recourse to further debt relief or rescheduling" (p.16).

Accordingly, I interpret credit affordability as *households' ability to afford credit loan constraints, which are the level of debt, interest rate, transaction cost, the cost of originating a loan, penalty fee (if any) based on a current financial situation (measured by income, savings) and consumption behaviour.*

Moreover, the *expectations* about economic growth, house price growth, unemployment and interest rate fluctuations can all contribute to an assessment of households' ability to pay a loan on the future. However, the underlying problem here is that the expectations reflect the current stage of economy: in boom times they are often over-optimistic, while in bust times they are often over-pessimistic.

Thus, credit affordability measure should capture the cost of debt and the current ability to manage this cost. However, the potential interest rate increase has to be taken into consideration.

In the following section, I propose possible measures of credit affordability.

3.5 Credit affordability measures

The cost of debt is measured by the interest payments and interest burden. The ability to manage the debt service burden is measured by financial margin.

3.5.1 Credit affordability by interest payments and interest burden

The outstanding mortgage debt, however, is not a true reflection of the actual costs that the owner-occupier has to face (Neuteboom, 2004). The costs of the mortgage are determined first (and foremost) by the nominal mortgage interest rate and the level of outstanding debt (Neuteboom, 2004).

I have showed that the mortgage debt as a proportion of gross national disposable income, GDP and housing value has increased, resulting in increased payments. From another side, the increase of mortgage debt burdens can be explained by the improved ability to service that debt (Girouard *et al*., 2006a). From 2000 till 2003, in Denmark, France, Germany, Ireland, Italy, Spain, Sweden and the United Kingdom, the proportion of *household income required to pay the interest rate* on mortgages had increased, reflecting the increased size of mortgages (Girouard *et al*., 2006a) and the improved credit affordability.

Therefore, the monthly cost on debt in relation to income (or interest rate payments as a percentage of net income) represents the ability of households to service the debt cost (the interest burden measure). For example, in The Netherlands, actual interest burden is widely used

as a key factor to determine mortgage affordability; so far, however, it is not applied in an international assessment (Neuteboom, 2004).

3.5.2 Credit affordability by net financial margin

Danmarks Nationalbank (2010a) sums op household's ability to serve their debt as the financial margin (demonstrated in box 4). The same ratio can be used as an appropriate proxy of default risk (Hollo and Papp, 2007). I will use the measure of financial margin as a measure of credit affordability, or households' capacity to service the debt burden.

Box 4 Net Financial Margin formula

Net Financial margin=

The household's disposable income after net interests cost and tax

- Housing -related cost (excluding repayment on loans)
- Minimum consumption cost

Source: Danmarks Nationalbank (2010a)

At the cost equal disposable income, household's financial margin is zero. A household with a financial margin of zero cannot afford to repay its debt at minimum consumption. A household with a negative financial margin is assumed to be unable to service its debt.

Logically, growth in lending should be correlated with a growth in financial margin.

3.5.3 Credit Affordability by Gross Financial Margin

Finlay (2006) had also proposed the similar measure of credit affordability, but he includes *all income* and all *cost (not only minimum*). It's so- called Gross Financial Margin:

Box 5 Gross Financial Margin formula

Gross Financial margin=

The household's disposable income after net interests cost and tax *including bonuses, state benefits*

- Housing -related cost (*including* repayment on mortgage and other existing commitments)
- Other non- credit expenditures (rent, bills, food, travel, and luxuries, so on)

Source: Finlay (2006)

However, he prefers relative affordability measure to an absolute measure; therefore Finlay (2006) proposed a ratio of affordability to net income as a measure of credit affordability development assessment.

Apart from measuring households' ability to service the debt service burden, there are other advantages in using credit affordability concept. This will be the topic in the following discussion.

3.6 Credit affordability in practice and its perspectives

3.6.1 Credit affordability and rational lending

In the UK, the Task Force, mentioned in section 3.4.1 has conducted a survey on credit affordability from which they found the evidence of irrational lending. More than 20 % of the population was granted credit that they could not afford to refund and to pay (Consumer Affairs Directorate, 2005). However, irresponsible lending and irresponsible borrowing are two sides of the same coin.

They found clear evidence of borrowers acting irresponsibly and following patterns of irrational borrowing:

• *Borrowing money when already in financial difficulty to pay off other credit or to pay off arrears on bills and other commitments*

• *Taking on credit agreements, despite knowing that they will struggle to repay the money*

• *And impulsive shopping and credit use by consumers who buy things on the spur of the moment, knowing that they will not be able to repay or do not consider whether they will be able to do so* (Consumer Affairs Directorate, 2005).

The Task Force agreed that many consumers take out a loan without giving detailed consideration to key factors such as:

- *Can I afford this loan?*
- *How much will it cost me?*
- *How can I get the best deal?*
- *Will I still be able to afford it if my circumstances change?* (Consumer Affairs Directorate, 2005)

Thus, the assessment of credit affordability and control can limit irrational lending and borrowing. However, many lenders work on different levels of profitability (Finlay, 2009), therefore, they might have different approaches in assessing credit affordability. Income is still an important factor, but there will be differences in what level of income is acceptable when granting a loan. Therefore, some institutions borrow to a customer who is already heavily indebted, resulting in over-indebtedness, while other institutions may reject this customer. The so-called "stretched" affordability was seen in the past, also through the use of interest-only and the extending of mortgage terms. This is also the evidence of irrational lending (Financial Service Authorities, 2010).

However, according to Hansen *et al*. (2009), the chances of irrational *mortgage* lending are lower. Because of bigger debt, underlying risks and time for re-payment, it will be expected that banks will be more careful in mortgage lending, but, on the contrary, I have shown that we experienced irrational mortgage lending, driven by high expectations in future housing prices, high investment return opportunities and under-estimation of underlying risks.

3.6.2 Credit affordability and financial stability

Lunde (2008b) analysed how the owner-occupier sector, as an important part of the Danish economy is linked to financial fragility via increased indebtedness.

The following ratios reflect important economic housing conditions for owner-occupiers sector, which are also important to financial stability:

- Household debt/ GDP ratio
- Household debt/ disposable income ratio
- Total liability / net wealth ratio
- Mortgage debt/ net non-financial wealth
- Housing wealth/ income ratio
- Net liability/ income ratio
- Net liability/ housing wealth ratio
- Net interest expenditure/ income ratio

The same ratios can be used to assess credit affordability. For example, the fall in the net interest expenditure to income ratio from 20 per cent in 1987 to fewer than 10 per cent in 2005 among 30-39-years-of-age group (a proxy for first-time buyers) indicated improved affordability of owner occupation in Denmark (Lunde, 2008b, p.59) [15]. Please note, if a household has interest payments of 20 per cent of the income disposable in our days, it will get a status of "over- indebted household" (Consumer Affairs Directorate, 2005). Part of the movement is related to the shift between fixed rate mortgages to adjustable-rate mortgages. However, the improvements over later years are weak, when the reduced tax rebate is taken into consideration (Lunde, 2008b).

The ratios are important risk indicators for lenders, who use properties as collateral, for financial and monetary authorities and for national economic policies. As they can be used for predicting default risk and send "early warnings" on a coming financial instability (Lunde, 2008b).

The ratios can be applied at *the family level as well as on the aggregate level.*

However, the analysis on the macro level might be misleading. For example, an increase in net liability-to-income ratios (a measure of leverage) amongst low-income groups, for example, is likely to introduce a far greater risk to financial stability than an increase in the same ratio amongst high income groups (Lunde, 2009; Girouard *et al.*, 2006b).

[15] Those are pre- tax estimates. The increased affordability could be barely explained if including "after- tax" interest expenditure. There were reductions in interest expenditure deductions from taxable income from a maximum of 78 per cent to 33 per cent through three tax reform in Denmark (in 1987, 1994, 1999) (Lunde, 2008b)

Thus, the analysis of credit affordability on the aggregate level is necessary for financial stability assessments, because it represents the risk of default and over-indebtedness.

3.6.3 Credit granting decision and counseling

Credit affordability analyses should be incorporated into credit granting (borrowing) decision.
It determines the level of debt a household can tolerate in relation to its income and outgoings.
In practice, the bank Nordea in Finland (www.nordea.fi:"Further improvement in housing affordability") employs the housing affordability index as a relationship between housing prices and *monthly loan servicing cost*. Thus, the current low interest rates on housing loans enhance the housing affordability, and trigger a rise of the housing prices.
However, I discussed that if only financial costs are included, the housing affordability will be over-estimated. Not only debt cost, but also cost of maintenance and repair should influence the housing buying decision. If these cost items are ignored in credit granting decisions, there will be much flexibility in measuring the credit affordability, resulting in increased indebtedness.

When banks do not include housing-related costs into the credit affordability measure, they are willing to grant loans that are significantly higher than allowed by the rule-of-thumb.
What banks' concern should be is, of cause, credit affordability dependent on both income and expenditure. However, housing affordability- the ability to sustain a house including all housing-related costs should also influence the credit granting decision. This would limit credit access in boom times, a main trigger for housing boom (Muellbauer, 2008; Kindleberger, 2005).

3.6.4 Regulation

Improved housing affordability can happen via improved credit affordability. For example, prior to the 1970s, in New Zealand, in order to expand homeownership, the state support maintained low mortgage interest rates and enlarged the supply of housing. It improved housing affordability through cheap credits to new home-owners together with subsidies to the building industry, all of which caused a massive expansion in home ownership rates from 50,5 % in 1936 to 68 % in 1971 (Broom, 2009). However, after the 70's, state support for expanding home ownership weakened, resulting in a decrease in lending activities by 38 % from 1978 till 1990. As a result, the low income class was locked out of the property market because of worsened credit affordability (Broome, 2009).
Thus, control of credit affordability via decreasing interest rate can lead to improved housing affordability for low income groups.

To sum up, the perspectives on credit affordability demonstrated that the credit affordability concept is significant. The analyses of credit affordability can be valuable in assessing the degree of over-indebtedness and irrational lending, financial stability and financial decision making. But more importantly, the changes in credit affordability result in changes in the housing prices equilibrium in the long- run. I shall now discuss these issues from an empirical perspective.

3.7 Empirical findings on credit affordability and housing prices

Academic literature had emphasized the role of credit expansion, low interest rate and financial improvements as drives in explaining house price inflations (see among others Green and Wachter, 2007; Muellbauer, 2008; Case and Quigley, 2008; André, 2010; also table on empirical evidence in appendix 19A).

However, little evidence had been produced directly proving that lower interest burden (interest payments as a percentage of income) rather than lower interest rate could explain the housing boom. In the academic field, according to Goodhart and Hofmann (2007), there are *"only a few studies assessing the relationship between credit aggregates, economic activity and property prices in a formal way*" (p. 89).

For example, Vries and Boelhouwer's (2009) empirical analysis shows good statistical results on the long-run relationship between *net interest payment and income on housing prices*. They make *credit affordability* the key element in the long-run equilibrium of housing prices. Thus, the interest payments-to-income ratio, instead of price-to-income ratio, is an appropriate measure of housing affordability (see also section 2.6 in my project).

In addition, some studies, demonstrated the effect of improved credit affordability on housing prices indirectly. The introduction of adjustable-rate (ARM) and interest-only mortgages (IOM) and its strong increase has underpinned the strong real house price growth (Skaarup and Brødker, 2010, Mortensen, Seabrook, 2009) and contributed by 19 per cent into house price growth (Wagner, 2006).

Danmarks Nationalbank (2011) had found that increase in real housing prices would be "only" 40 per cent instead of 71 per cent, were new types of mortgage loans not introduced.

To conclude, the developments in credit affordability affect housing demand and housing prices.

Also, the developments in credit affordability are significant to rational lending, financial stability, housing market and economy in general. Right assessment, understanding and control of credit affordability might limit over-indebtedness, irrational lending and borrowing, which in turn can reduce housing boom and bust problems.

In the following, I shall apply the measures of credit affordability to assess credit affordability development on the aggregate level in Denmark.

3.8 An analysis of credit affordability development in Denmark during the 1993- 2010 period

3.8.1 Interest payments development

An indicator of households' mortgage interest payments is constructed based on actual mortgage debt and a typical published mortgage interest rate (Girouard *et al*, 2006a).

There were no separate data on lending to the two groups- flat and house owner-occupiers. Therefore, I will apply aggregate mortgage credit lending to the owner-occupier sector (see appendix 26A, also tables 7, 8 in appendix B).

The table bellow summarized general developments in *total nominal mortgage lending* at the beginning of boom years (1994- 2000), for the period of extraordinary boom years (2000- 2006) and bust years (2007- 2010):

Table 5 Total mortgage lending and mortgage rate developments

	Average mortgage lending level, DKK Mill	Average growth in mortgage lending, %	Average official mortgage rate, %	Average interest payments, DKK Million	Average growth in interest payments , %	Average Inflation , %
1994-2000	894.971	7,80	4,16	38.931	3,51	2,16
2001- 2006	1.644.427	9,21	3,00	45.597	0,87	1,96
2007- 2010	2.579.588	5,03	2,48	66.931	-38,55	2,19

Source: Danmarks Nationalbank and own calculations

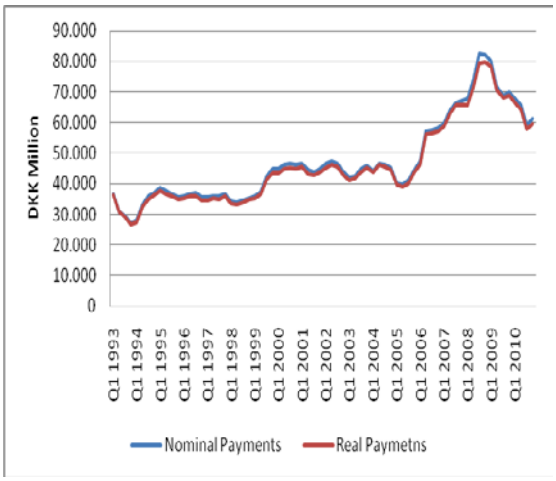
Generally, the housing boom years were categorized by high increase in indebtedness, with the average increase by 9, 21% per year in nominal terms (and 9, 03% in real terms), while in pre-boom years the average increase was 7, 8% (7, 6%) and 5, 03% (4, 91%) in bust years.

The increase in indebtedness in boom times can be explained by low interest rate (in average, 3 % in nominal terms and 1 % in real terms), which contributed to lower increase in interest payments compared to higher increase in debt outstanding.

It is interesting, that from 2005 till 2006, the total mortgage lending increased by 12, 22% in nominal terms - the biggest increase since 1998. This increase in indebtedness can be explained by lower interest rate, previous house price increase and ensuing beliefs in the constant increase of the housing prices.

The decline in nominal interest rate of 5 % in 2000 till 2% in 2002 can be seen as one of the most important trigger for improved credit affordability and, thus, increased credit growth. Moreover, this decline can explain the increase in disposable income and housing price increase.

Figure 9 Owner- occupiers mortgage payments development, Denmark



The figure 9 demonstrates constructed *owner-occupiers'* interest payments development (see table 8 in appendix B). Thus, the real interest payments of the owner- occupiers' sector were at a steady level during 2000:Q1- 2005:Q1, with a decline by 1% in nominal and 2% in real terms. The level of mortgage lending to the owner- occupiers' sector had increased by 125% for the corresponding period. Thus, this increase can be explained by lower interest payments.

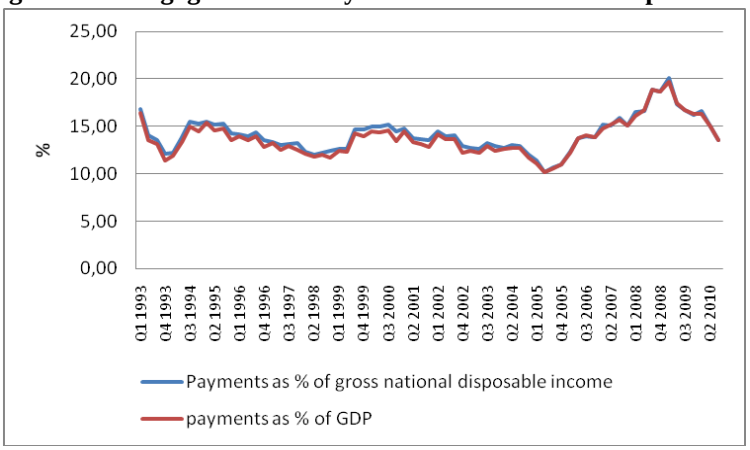
Source: Danmarks Nationalbank and own calculations

In the following, I analyze the interest payments development in relation to income, an interest burden ratio

3.8.2 Interest burden development

The decrease in interest burden for owner- occupier sector from 2000:Q1 till 2005:Q2 (measured as interest payments-to-income disposable) from 15 per cent till 10 per cent (see figure 10) indicates the improved ability to service the debt even at increased debt burden.

Figure 10 Mortgage Interest Payments as % of income disposable



However, from 2005 to 2009, the interest burden had increased from 10 per cent to 20 per cent. Thus, already in 2005, there was evidence of an increasing interest rate exposure (see also table 9 in appendix B).

Source: Danmarks Statistics, Danmarks Nationalbank and own calculations

To conclude, during boom times in the lending sector we observe the indication of improved credit affordability only for the period 2000-2005, measured by steady interest payments and declined interest burden. However, considering that the debt level in relation to GDP and income and interest rate risk exposure had also increased, it does not make households financially strong, as was defined in Danmarks Nationalbank's Financial Stability report from 2006.

3.8.3 Critique on interest payments and interest burden measures

The analysis is based on projected payments; however, in reality, households may face higher interest payments (annual percentage rate of charge- a true cost of borrowing, Finlay, 2006). The Danish Statistics have the data on the effective interest rate including fees, however, starting only from 2003. Due to the lack of data for the previous years, I could not apply these in my study. However, comparing the projected interest payments with actual interest payments (though first from 2003), I observe similar trends in the developments (see appendix 27A).

Furthermore, as already explained in my study, the assessment of credit affordability is not complete without assessing the amount of payments spend in relation to other housing-related and non-housing related costs (I made the comparisons of payment to other costs in appendix 28 A).

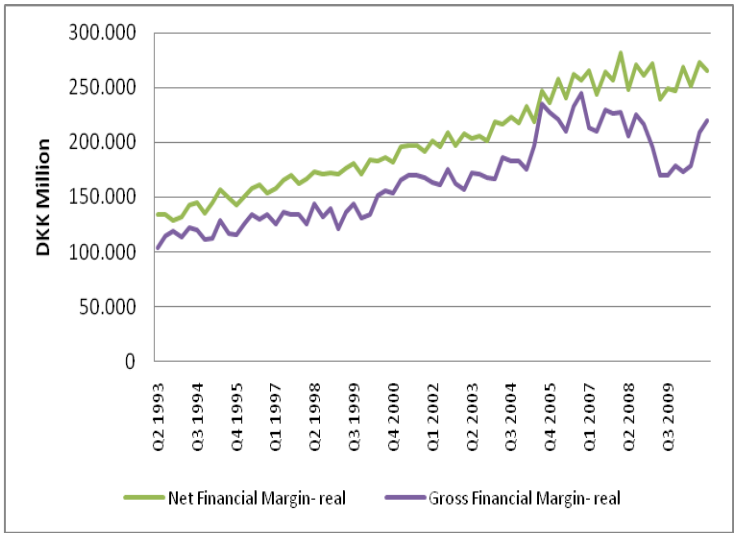
Moreover, the assessment of credit affordability is not complete without measuring households' ability to manage those debt burdens by measuring the income available after subtracting households' expenditure. In the following sub-sections, I assess how households' ability to service their debt and interest burdens has developed, measured by financial margin.

3.8.4 Net Financial Margin development

The analysis of net financial margin is based on net disposable income (income earned less interest payments and tax), less housing consumption (excluding interest payments), less consumption on food (I separate items, such as households' food and beverage consumption and consumption on clothing and footwear, out of the households' total consumption, and therefore they are proxies for minimum consumption cost).

The Net financial margin development is shown in the following figure:

Figure 11 Net and Gross Financial Margin Developments



From 1993 till 2010, the net financial margin increased by 78% in real terms and by 115 in nominal, mainly driven by the growth in gross disposable income, which has increased by 70% in real terms and by 102% in nominal for the corresponding period (see appendix 29A and table 10 in appendix B).

Source: Danmarks Statistics and own calculations

The increased gross financial margin should be associated with increased credit demand.

However, comparing Net Financial Margin to owner-occupier mortgage lending (see figure 59 in appendix 29A), there is a noticeable increase in the gap between mortgage lending and net financial margin.

Thus, the increase in mortgage lending can somehow be explained by improved net financial margin. However, the financial margin increased by 78% in real terms, while total mortgage lending to owner- occupied sector increased by 123% in real terms. *I underlined this as an indicator of the imbalance in credit affordability development- the growth in mortgage lending outpaced the development in financial margin.*

3.8.5 Critique of the net financial margin measure

Financial margin is not a perfect picture of debt affordability. This assumption excludes a large number of elements:

1) A household will not necessarily cut down its consumption to the fixed minimum level after entering the credit agreement.

2) It is also difficult to come to a consensus as to what constitutes minimum consumption and housing-related costs. Is it the bare essential of food, clothing and shelter, or should it include expenditure on pensions, holidays, eating out and so on? (Finlay, 2009) Is a car an essential item of expenditure? If so, what kind of car? (Finlay, 2009) What about expenditure on children's education? If all these items are included, the net financial margin will be reduced substantially.

The earlier mentioned Task Force (see sub-section 3.4.1), for example, in the report on tackling over- indebtedness recommended that income less existing commitments (including *non-credit ones* such as rent and utility bills, as well as general housekeeping) represents households' borrowing ability (Consumer Affairs Directorate, 2001). Thus, including minimum consumption cost only when measuring affordability is not enough.

3) Increased consumption costs are associated with additional risk of debt (Berthoud and Kempson, 1992. However, it is out of banks' reach to find out what the real consumption costs of a household are. In fact, some borrowers may even lie in order to get a credit.

4) There is always "unpredictable risk" in consumption structure change, such as new-born family member, sudden death, divorce, etc. These factors can cause financial difficulties in the future, even if a household was defined financially sound at the first place.

6) The financial relationship between household's members is also questioned. If an individual applied for credit, should the income and outgoings of other household members be included or excluded in any assessment of their ability to pay? (Finlay, 2009)

7) Another uncertainty around financial margin is that the financial margin do not necessarily allow for the fact that a household can liquidate its assets before defaulting on its debt. The financial margin does not include *housing, financial wealth, savings and pensions*- the alternative sources of income.

8) The financial margin does not include state benefits (which are high in Denmark).

9) The proposed measure of affordability is an aggregate measure. The aggregate measures, however, can yield misleading results (Lunde, 2008b) because "*they mask differences in vulnerabilities across income groups*" (Girouard *et al*., 2006b, p.2). The aggregate measure might not capture the changes in earnings for different income groups, regions, etc. For example, a rise in debt as a proportion to income ratio amongst low-income groups poses higher risks to financial stability than the same ratio increase amongst high-income groups (Lunde, 2008b).

To fulfil the gap in the analysis, I apply the Net Financial Margin ratio to different households' demographic groups. For the analysis across households' demographics (across home-owner types, occupation types, age, household types,) see appendix 32A, figures 62-69.

To conclude, financial margin measure provides a good general picture of the household's ability to service their debt at a given time period; therefore, I used it at the initial stage of analysis.

However, the above mentioned factors posed some uncertainty regarding whether calculating net financial margin, proposed by Danmarks Nationalbank, is a right measure to ensure that any credit-debt relationship entered into is affordable. Nor does it include the cost on mortgages.

Therefore, I extend the measure of Net Financial Margin by introducing Gross Financial Margin.

In Gross Financial Margin, all other income items and expenditures are taken into account.

3.8.6 Gross Financial Margin Development

Gross financial margin is calculated by gross disposable income (including all income, net savings and property income) less all households' expenditures, less interest payments.

According to figure 11, from 1993 till 2010 the gross financial margin had increased by 75 per cent in real terms. However, after 2005:Q2, the gross financial margin decreased as a result of increased interest payments (see appendix 30A, figure 60). According to this approach, the households' ability to service their debt has declined already in 2005. In 2006:Q4, we can observe the highest decline by 13, 57% in real terms. Thus, already in 2005, the decline in households' ability to service their debt burden could be seen as a first signal of increased risk exposure.

Thus, on the aggregate level, the credit affordability of households had declined in 2005, mainly because of increased interest payments; however, mortgage lending had continued to increase.

The increased gap in mortgage lending and credit affordability (measured by gross financial margin) is an indicator of imbalance on the mortgage market.

3.8.7 Critique on Gross Financial Margin

1) The measure does not capture the households' demographics in relation to its re-payment ability. The Consumer Affairs Directorate (2003) has found that the loss of affordability can also be caused by other factors, such as setting up home and having a family and with relationship breakdown. However, such factors are difficult to foresee (Finlay, 2009), but must be taken into account. (Therefore, I extent the analysis on Gross Financial Margin across demographics, see appendix 32A).

2) The underlying assumption is that growth in income improves borrowing ability. In the appendix 31A, I present the arguments to the effect that growth in income can also have a negative effect on credit affordability.

3.8.8 Gross Financial Margin vs. Net Financial Margin- a discussion

Generally, comparing gross and net financial margin development across household type indicates big differences between different categories (see appendix 32A for extended analysis):

- Financial margin across households types
- Financial margin across owner- occupiers' status
- Financial margin across income level groups
- Financial margin across socio- economic status of the main income earner.

The Gross financial margin is a "real" measure of households' ability to re- pay a loan. Including interest payments into this measure is important.

Using gross financial margin in credit affordability assessment makes households more vulnerable to default. Thus, the households' vulnerability to default has significantly increased between 2004 and 2005. Net financial margin development is "smoother" in comparison with gross financial margin measure because it does not show the interest payments expenditure. (see appendix 29 A) Consequently, the former one does not show the interest rate risk exposure and households' vulnerability to default if interest rates increase.

Therefore, lending based on gross margin and net margin will result in different lending levels. There will be higher lending activities if based on net financial margin.

Generally, there were bigger fluctuations in gross financial margin among different households than in net financial margins. Since the gross financial margin reflects all expenditures, it is

therefore a more credible indication of households risk exposure (here measured by all consumption, interest rate and debt exposure).
In terms of rational lending, it is therefore important to use the gross measure. It provides a more transparent picture of a household's income- consumption relationship and thus, of its real credit affordability (the ability to service its debt).

3.9 External factors and affordability

In the following section, I look at other forces that influence the perception of affordability[16].
The table below provides some of the variables that affect housing affordability on the long run, based on studies by Berry and Hall (2001), see box below:

Box 5 External factors to affordability assessment according to Berry and Hall (2001)

Inflation, interest rates and real interest rates (repayments required)

Incomes and earnings (capacity to pay)

Unemployment and employment conditions (market participation and earnings potential)

Dwelling prices and rents (payment requirements)

Mortgage and rent payments (savings capacity, ability to increase housing consumption)

Tenure (impact of market economics, housing choice)

Mobility or frequency of residential relocation (aggregate housing demand and price and rent impacts)

In addition, I add the following variables:

Box 6: External factors to affordability assessment (own estimation)

GDP (economic situation, earnings potentials, security, welfare)

Changes in property taxes (changes in disposable income)

Foreclosure level (willingness to lend to a private sector based on probability of a default)

General level of taxes and in connection with properties

Optimism in good times (high GDP growth, low unemployment) and pessimism in bad times (low GDP growth, high foreclosure level) play an important role in cash flow estimation (Danmarks Nationalbank, 2007, p.81), and therefore in affordability assessment. Let me give some examples of how optimism/ pessimism might influence the perception of affordability.
For example, the probability of default in optimistic and pessimistic times influences the banks' lending level differently. In good times, *the probability of default* decreases. Banks are therefore willing to lend more, and the supply of credit increases. In periods of high lending growth credit

[16] Since I limit the analysis of the housing market by demand driven factors, I will disregard the supply factors and their affect on housing prices.

quality often diminished. Thus, financial institutions are willing to lend more than what is affordable.

However, increased growth and relaxed credit quality in lending may lead to higher losses and write-downs in the following years (especially followed by recession years).
Because *of increased probability of defaults* (in the housing downturn, or an economic recession in general), banks become less willing to make mortgage loans, resulting in further drop in housing prices. So, even if housing is more affordable (because of price decline), the macro-economic risks influence the housing and credit affordability assessment.

Another example, in times of recession and unemployment growth, it is generally believed that the risk of being unemployed is increased. Thus, the *expected* ability to pay a loan diminishes, even if the *actual* housing affordability is unchanged.
Thus, the changes in housing affordability will have different effects on housing prices depending on the state of economy.
This means that improved affordability in bad times (as a result of lower housing prices) will not increase the housing demand and the housing prices, as there is a general fear of job loss or further house price decline.
On the other hand, declined affordability in good times (as a result of higher housing prices) will increase housing demand, because there is a general belief that the housing prices will continue to increase. The declined affordability will thus give people incentive to buy early in order to protect themselves against the risk of future price increase that would make houses unaffordable.
Also, the study by Bramley (2010) suggests "*an elasticity of 2.3 linking problems to interest rates, and 0.5 to unemployment, suggesting that a 2% point rise in the former and a doubling of the latter could lead to a rise of 150% in serious mortgage affordability problems and ultimately to repossessions*"(p.20).

3.10 Sub- conclusion on credit affordability

In housing boom times, with lower interest rates, the increase in indebtedness can be explained by improved ability to service this debt. The increase in mortgage debt (in average by 9, 21 % per year) can be explained by steady interest payments (only 0, 87 growth) taking into account the higher level of debt. Consequently, lower interest payments traded- off higher housing prices. Therefore, the improved credit affordability was an incentive to enter the housing market even when housing prices skyrocketed.

However, the proportion of disposable income to service this debt had decreased since 2000. It made households more vulnerable to default if interest rate change or/and housing prices fall, or if other unfavorable conditions occur.

In bust times, the demand for mortgage credit was lower (the average increase by 5, 03 %) even at a lower interest rate. It contributed to a decline in interest payments (by 38, 55 per cent) and to a decline in interest burden. However, because of a decline in earnings (as a result of increased unemployment) and general pessimism on the market, there was no positive reaction on the housing market.

My findings support the empirical work by Vries and Boelhouwer (2009) seeing interest payments, instead of income level as a main factor in housing affordability and the long-run housing price equilibrium. However, not only the interest payments, but also other housing costs, related to the buying and maintaining of a house, constitute housing affordability and housing economy. Thus, the lending should be based on real housing affordability, taking into account all other housing-related costs. (I extend this in the recommendation.)

4 Reflections from the Project

In the following chapter, I evaluate how housing price would have developed under the assumption that long-term housing equilibrium is determined by housing affordability. The results are also an answer to the last sub- question (no.6) of the problem formulation: what would be the projected housing prices if the prices were in equilibrium with housing affordability.

In an attempt to accurately measure housing affordability, Stone (2006) made a compelling argument in favor of the residual income approach as an alternative to the price-to-income ratio approach. Non-housing expenditures are limited by how much is left after paying for housing. This means that a household might have a housing affordability problem if it cannot meet its non-housing needs after paying housing-related costs. In Stone's (2006) view, this would be a more appropriate indicator of affordability as opposed to the standard ratio that is so amply used. The critical point here is to decide which housing-related cost are relevant, and how much income should be left after paying housing related cost.

The framework from this approach and results of my analysis on affordability will create a synthesis for my model.

4.1.1 Model variables

Based on my discussion on the housing affordability concept, I outline the main variables to be applied in measuring housing affordability by residual income approach. In this calculation, housing related costs and credit costs are calculated for a surface area of 107 square meters, which, according to Statistics Denmark, is the average size of a home in Denmark (see table 1 in this project):

- The loan taken out to purchase the home is 80 per cent of the purchase price and the loan period is 30 years. The yearly installments are defined as total loan divided by 30 years
- Interest payment derived as a 30-year mortgage bond yield multiplied by the outstanding mortgage loan
- Other payment costs include insurance cost and property taxes, but exclude tax shield[17].
- Housing- related cost (repair and maintenance) correspond to 1 % of housing price (based on historical average)
- The sum of all costs should not exceed 30 % of a household's gross disposable income.
- The minimum required income constitute 130% of all housing-related cost on the assumption that housing-related costs, including financing costs should not exceed 30 % of gross disposable income

The minimum required income is then compared to actual average gross disposable income in order to find a difference. If this difference is close to zero or above, an average household earn enough to buy and sustain the average house. The difference below zero indicates that a household does not have sufficient disposable income to buy an average house. It is also the indication that housing prices are overvalued and that there are imbalances in housing affordability.

[17] A **tax shield** is the reduction in income taxes that results from taking an allowable deduction from taxable income. For example, because interest on debt is a tax-deductible expense, taking on debt creates a tax shield. Since a tax shield is a way to save cash flows, it increases the value of the business, and it is an important aspect of business valuation. (Wikipedia. Org)

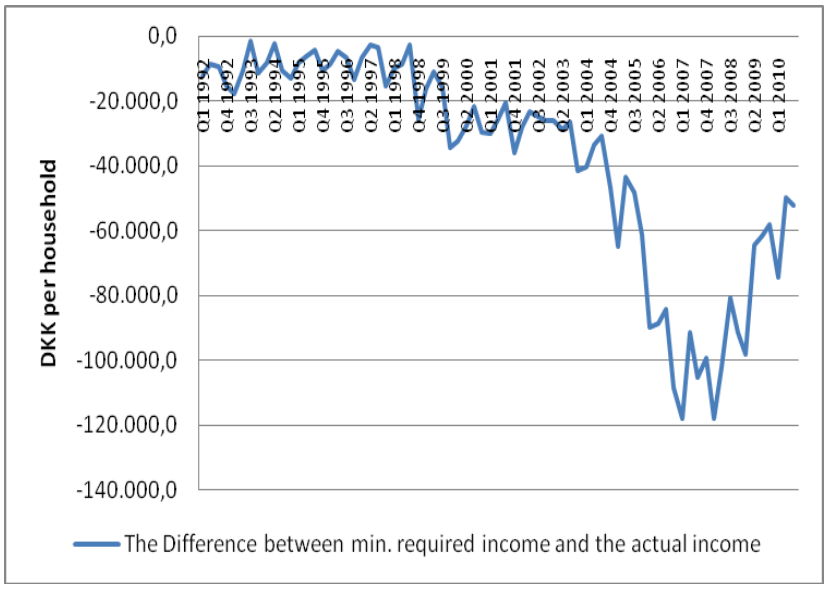
period	*reductions*
1987- 1993	from 73 till 50 %
1993- 1998	from 50 till 46 %
1998- 2001 (pinespakken)	46- 32 %
2001-	33 %

Source: www.skat.dk

The increase in the ammount of tax deductable increase households' affordability by the amount that is "paid back" by tax.

4.1.2 Model applications

Figure 12: The difference between minimum required income and the actual income



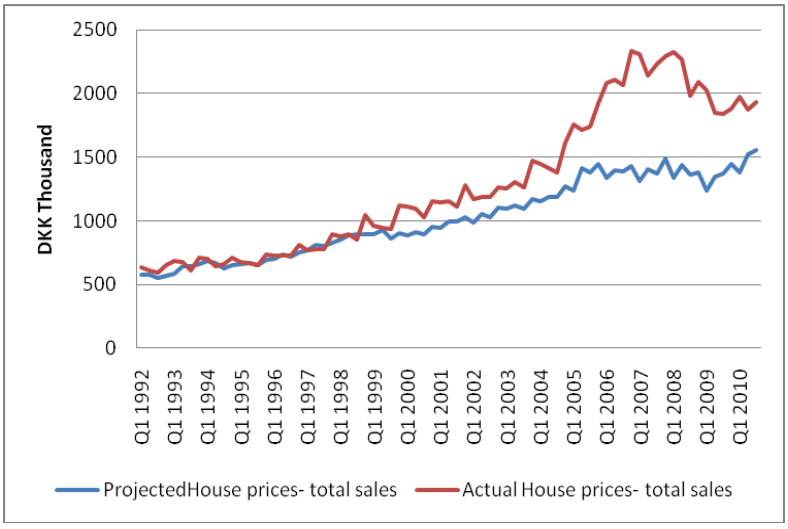
The figure 12 shows the difference between minimum required income and actual income. From 1992 to 1999, an average household earned enough disposable income to buy and sustain an average house (for the calculations, see table 12 the appendix B).

Source: own calculations

Since 1999, an average household cannot afford the average house because the actual income was lower than the minimum required. As a result of the housing bust, the housing affordability has improved since 2006 and the price adjustment has begun.

Based on the assumption that the housing affordability (first- year payments in relation to income) determines the housing price level, I estimate the development in the buying housing price level during the 1993- 2010 period. The projected housing price developments based on this assumption are depicted in figure 13. According to this model, the price-to-income equilibrium is constant.

Figure 13 Projected and actual housing prices



Source: own calculations

In order for price and income to stay in equilibrium, there should have been further housing price adjustments in 2010 (see table 6):

Table 6 Projected Housing Prices for year 2010

	Actual price , DKK thousand	Projected price, DKK thousand	Projected decline, %
Q1 2010	1973	1425	-32,5
Q2 2010	1877	1566	-18,1
Q3 2010	1931	1591	-19,3
Q4 2010	1893	1508	-22,8

Source: own calculations

With this house price development, households' housing-related costs (as a function of housing prices) and subsequent minimum required income would be close to actual income and an indication of price- income equilibrium. However, the underlying weakness in this assumption is that the housing affordability and housing equilibrium is purely subjective. Other demand and supply-driven factors affect long-run equilibrium. The disregarding of the supply variables can lead to an under- or over-estimation of the housing prices.

Nevertheless, studies by OECD (André, 2010) made similar projection of housing prices based on the assumption that price-to-income ratio should be constant. According to the studies, the ratio is still above its long-term average, and, therefore, the housing prices are still over-valued.
Also, according to Lunde, today, the housing prices are still over- valued: "*We have had a historically long upswing in prices, and now we are engaged in a prolonged slump. Prices can sometimes be stable, as was the case in 2010, but the curve will generally be downward for many years*" (*Børsen*, 2011).
From my analysis, I found that housing prices that are ca. 20 per cent lower than the current level should be affordable to an average household.

4.1.3 Sensitivity Analysis

I extend my forecast and propose different scenarios including how changes in interest rate and tax shield can affect housing prices, all other variables are constant (see appendix 34A).

4.1.4 Limitations

If a housing purchase and lending decisions are to be based on the so- called "first-year affordability approach", as I estimated by my model, it not capture a range of relevant factors.

Macroeconomic risk and opportunities

The model does not capture factors, such as changes in general economic developments, general level of unemployment, residential investments. However, how the macroeconomic risk can be incorporated into lending decision (for example, into credit scoring) is a general problem in designing lending decision models (Zandi, 1998).

Housing consumer choices

Though, widely accepted in studies, there is no theoretical evidence behind the logic that housing-related cost should constitute no more than 30 per cent of disposable income. Also, it lacks detail on the underlying logic. So, some families might spend more than 30 per cent, or less. Moreover, borrowers might change its consumption behavior in order to afford housing-related costs. In this sense, the affordability standards do not have any independent or theoretical basis against which households' actual choices can be measured. How consumer choices will develop after the purchase of the house cannot be foreseen.

Future financial soundness

The model derives" first-year affordability", but, it does not include next year payments. "*The overwhelming evidence that many/most affordability problems are associated with change of circumstances after the origination of the mortgage (job loss or change, illness, relationship breakdown) underlines the point that there is a strong risk dimension to the problem*" (Bramley, 2010, p. 19). Thus, affordability problems may arise after marriage break-up, sudden illness, death. Hence, the model does not consider the households' future financial soundness.

5 Conclusion of the Project

In 2008, the global economy was hit by a crisis, compared to the Great Depression in the 1930's. Since then, studies attempted to identify the triggers, and the housing market seemed to obtain a leading position among the triggers.

My overall purpose was to investigate the Danish housing market on the background of global research, in order to find the indicators of the imbalances. I assumed that those imbalances could be measured by using the housing affordability approach during the recent housing boom and bust. Therefore, I investigated housing market developments by using the "housing affordability" method. In particular, I aimed to answer:

How had housing prices and the level of housing affordability developed in Denmark during the 1993- 2010 periods?

My structuring questions were:

1. What is housing affordability and how can it be measured?
2. Should changes in housing affordability bring housing prices towards long-run equilibrium (from a theoretical perspective)?
3. What is credit affordability and how can it be measured?
4. How did housing and credit affordability develop during the recent housing boom and bust?
5. What are the kinds of imbalances on the housing market that can be observed using housing affordability and credit affordability?
6. What would be the projected housing prices under the assumption that they should to be affordable to an average household (that there is equilibrium between price and residual income)?

1) I defined housing affordability as a combination of two factors:

- it is the ability of a household to buy and sustain an average house and its corresponding cost based on the households' current income;
- it is the realistic possibility of buying this house without being financially distressed after its purchase and without relying on the expectations of future price increase

There are multiple approaches, and therefore measures, for assessing housing affordability; however, the central building block is the relationship between housing prices and income. For example, a housing affordability index can indicate the maximum amount available for housing depending on household size and income (Stone, 1993) or measure the ability of a median- income family to buy a median- price home (www.realtor-housing affordability index).

The concept of housing affordability as a method to assess the housing market is widely used by practitioners, such as banks, mortgage institutions, real estate agents, housing counselors and regulators. Lenders, for example, use this approach to find the right level of debt (and affordable housing) at a given income (and savings, if any) level. On the aggregate level, the application can also tell us whether housing prices are over- or under- valued.

In spite of a wide use of the housing affordability concept by practitioners, the concept is rather loose as it can be measured in different ways. The main reasons are:

- different use of consumption costs items
- relying on adjustable interest rate mortgages
- prolonging mortgage repayment period

These differences can, in turn, lead to a higher possibility of over-indebtedness, speculation, irrational lending, and later, increased numbers of foreclosures, housing downturn and financial instability. A well defined, comprehensive definition and use of the housing affordability concept is therefore very important. I stressed this in view of the stability of the financial market.

2) In order to support the underlying assumption that an average house has to be affordable to an average family (or that long-term equilibrium should be determined by affordability), I applied theoretical assumptions assuming that changes in income should bring housing prices in equilibrium. This is, in turn, supported by the assumptions of efficient market hypothesis. First of all, housing prices should reflect the underlying fundamentals. Thus, the problem of under- and over-valuation (disequilibrium) might be expected to be a problem in the short-term. It is expected to be eliminated on the long run.

Secondly, the demand for housing should be driven by rational behavior, that is to say, the demand should be driven by households' current and future resources (in most cases measured by the income level). The past housing price development, under rational expectations, should not determine housing demand. In reality, however, the demand can be driven by past housing price behavior and by the belief that there will be constant housing price increase.

Thus, the correlation is seemed to appear strong under EMH assumptions: housing affordability (measured by price-to-income ratio) should bring housing prices into equilibrium. The empirical evidence, however, indicated that it is not the only factor that can affect the long-term equilibrium of housing prices.

If I had selected behavioral finance assumptions, the opposite effect could be expected. Declined affordability (as a result of house price increase) might give buyers an incentive to buy early in order to protect themselves against the risk of future price increases that would make houses even more unaffordable. In housing downturn times, the improved affordability (caused by housing price decline) can make first-time buyers reluctant to buy, because they expect a further decline. Thus, they will postpone housing purchase for a much longer time. Two different schools of thinking might pose different assumptions and different methodologies. Whether changes in housing affordability can bring housing prices back to equilibrium can thus be explained in two different ways.

Therefore, I concluded, the housing affordability approach is a reliable analytical approach to assess the housing market. It is based on the assumption that there is a balance between house prices and household incomes. Only on the short term, market imperfections may disturb the relationship between these variables, but on the long term, the balance will stay intact.

3) Recently, the housing affordability method was substituted by ”credit affordability”. Thus, the empirical work by Vries and Boelhouwer’s (2009) shows good statistical results on the long-run relationship between *net interest payment and income on housing prices*. They make *credit affordability* the key element in the long-run equilibrium of housing prices. Thus, they concluded that the interest payments-to-income ratio, instead of the price-to-income ratio was an appropriate measure of housing affordability. Consequently, I also raised the concept of credit affordability.
Credit affordability was defined as households’ ability to *afford credit loan constraints, which are the level of debt, interest rate, transaction cost, the cost of originating a loan, penalty fee (if any) based on a current financial situation (measured by income, savings) and consumption behaviour.*
It was a generally accepted opinion that improvement in credit supply conditions, such as financial innovation, securitization, new loan types and digitalization, had made loans cheaper. However, at the same time, the interest rate exposure, indebtedness, default risk had also increased. Therefore, it was my goal to measure credit demand-side conditions disregarding the supply side conditions.
To measure the credit demand-side conditions, I proposed the following approaches of credit affordability assessment:

- Financial burden measure- the proportion of income households paid for interest rate
- Financial margin measure- households’ ability to re-pay the underlying credit

However, I argued that assessment of housing affordability by “credit affordability” under-estimate housing-related cost, and therefore, real housing affordability. Therefore, the “credit affordability” approach is not a substitute to the “housing affordability” approach.

4) To measure the state of housing affordability for boom and bust periods, I had applied the price-to-income ratio. I found that during housing boom times (2003- 2006), housing affordability had declined significantly. Further analysis of interest burden development and financial margin development has shown that a decrease in interest rate improved financial ability to service households’ debt burden, even at a higher level of debt. There was a decline in the proportion of income paid for mortgage cost until 2005. This further contributed to increased credit demand, increased indebtedness and resulted in an increase in housing prices. Therefore, improved credit affordability traded-off declined housing affordability.

5) Furthermore, I outlined the imbalances on the housing and credit markets using affordability concepts through the analysis:

- Since 1998, there was bigger increase in flat prices than in house prices, while the disposable and earned income of house owner-occupiers was higher than for flat owner- occupiers
- The highest house price increase occurred in the Copenhagen area, a fact, which cannot be explained by income growth
- The housing prices were over-valued especially in 2000- 2006
- Since 2006- 2007, there were improvements in the price-to-income equilibrium, however, it still did not move towards its equilibrium. The average households still did not earn the minimum required income to afford the average house
- The households' credit affordability (measured by gross financial margin) significantly declined already in 2005; however, there was continuing growth in lending
- Prior to 2005, there were improvements in credit affordability, but not in housing affordability. It can be seen as a reason to irrational lending and borrowing, and to the financial instability and imbalances which, probably, triggered the crisis

6) The finding from the analysis provided sufficient information to solve the last sub-problem of the problem formulation: how would housing prices have developed under the assumption that average housing prices should be affordable to an average household? I applied residual income frameworks: all housing-related payments (as a function of housing price) shall not exceed 30 per cent of disposable income. On this assumption, I derived minimum required income (130 per cent of total housing-related payments). Then minimum income was compared to actual income. According to this calculation, housing became affordable when an average household has enough disposable income to cover all housing-related costs. In 1998, the gap increased, indicating that an average household did not earn enough to cover housing-related costs. Under this assumption, the housing prices should have declined or income should have increased in order for income and housing prices to be in balance.

The decline in prices in relation to income took place in 2006- and the housing price adjustment begun. However, according to this approach, there are still imbalances on the housing market. In order for housing prices to stay in equilibrium with income earned, there should be further decline in housing prices by ca. 20 per cent, or, alternatively, an increase in income also by 20 per cent. This alternative seems today remote for Denmark in the light of the current economic difficulties.

As an overall conclusion, it can be stated that the housing affordability during boom times was not driven by price-to-income equilibrium, but rather interest payments-to-income correlation. Thus, the housing prices were determined not by the income earned, but rather by the cost on credit to finance

this house. Housing equilibrium was not driven by the housing affordability, but by the credit affordability. The improved credit affordability, together with the easy access to credit, created a credit boom and contributed to the housing boom.

To sustain housing prices, there should be a relative equilibrium between the level of housing prices and the underlying fundamentals. Therefore, it is important to integrate the housing affordability concept into housing purchase decisions. Thus housing demand should be driven by current income levels and current housing prices. And this is my starting point to represent the recommendations.

5.1 Recommendations

In the light of the current housing market instability facing many countries, there is much concern about how to solve the housing and subprime lending problems, and how to diminish the adverse consequences of housing market boom and bust.

"*While many of the past problems can be alleviated in some way by new legislation, the perennial issue of measuring real affordability of housing in relation to non-housing necessities remains unresolved. Perhaps, the solution is closer and simpler than what researchers, policy-makers, the housing industry, and educators have been proposing*" (Jewkes, Delgadillo and Lucy, 2010).

In this project, I argued for benefits of housing affordability approaches. Based on the argumentation, I can outline the following recommendations for regulations/lenders concerning housing affordability:

1. Lenders and/or borrowers have to use the affordability measure as the actual ability to pay *all* household housing-related costs in relation to income instead of speculations about home appreciation, or income increases.
2. The residual income approach (instead on price-to-income or interest cost-to-income) should be used in measuring housing affordability. It is the most accurate measure because there is a clear structure on cost decomposition, such as housing cost, non-housing, financing cost, etc; if relevant, other non-housing cost can be included (such as transportation, electricity, etc) into the measure. In addition, the measure can be used on both levels, on an aggregate level (as I did in chapter 4) and on a household level. Thus, the recommended approach represents different spectrum of the affordability concept and can be very easily adjusted for individual characteristics. (It can take into account household size and geographic location or other relevant demographics.)
3. Affordability measures/ assessment should vary as a function of the different phases of an economic cycle: "tighter" measure in boom time (to limit the over-confidence and further

housing price increase) and “looser” measure in bust times (to limit the over-pessimism and further housing price decline).

4. Measuring housing affordability should be a topic for further studies, as new developments or clarifications could lead to a better understanding of how to determine a household's ability to afford a given mortgage/housing. Moreover, first-time buyers should be educated by lenders on affordability issues. There is a need to instruct the potential buyers that the housing-related costs in relation to income, not the buyers’ future expectations of housing price development, should drive housing demand. Thus, there is a need for better clarity in the meaning of housing affordability and the relative merits of various conceptual approaches, with particular attention to the residual income model.

The flexibility in credit affordability measure also facilitates different lending levels. Here are four main recommendations on measuring credit affordability:

1. Gross financial margin measure of affordability should be used. It provides a better picture of households’ income-consumption relationship, as it includes all consumption items, while net financial margin includes minimum consumption only.
2. Income measured by wages and salaries should be a major source of households’ cash flow.
3. Housing wealth should not be regarded as “extra” income source and therefore, should not be included into households’ credit affordability measure. On the contrary, households’ housing market exposure should be assessed as households’ risk exposure to housing market (mainly because of underlying debt).
4. The measurements of households’ credit affordability should be developed and analysed on the basis of individual households’ characteristics instead of general economic development or general trends in housing prices.
5. The measurements of households’ ability to face their interest payments should be developed and analysed on the basis of applying “fixed” rate instead of “fluctuate” rate. The possibility of future interest rate increases should also be taken into consideration.
6. The assessment of individual/aggregate mortgage loans for a potential owner-occupier should be supported by credit affordability, not by general housing price development. Thus, lesser restrictions on lending can be justified if credit affordability improves, and not if housing prices increase.

My main recommendation to lenders and borrowers would be the following: the individual mortgage lending to the owner-occupier sector has to be based on the household/households' ability to buy a house and the future ability to sustain housing-related costs. Therefore, it is not enough that interest payments in relation to income should drive housing and credit demand. Realistic housing prices and actual estimates of housing expenses have to play an important role when making decisions about lending/borrowing money for the purchase of a house/flat.

5.2 Perspectives

In the chain of financial events that started from October 2008, the new economic period has begun, which, hopefully, will be characterized by a deeper understanding of risk factors, a lower appetite for returns, a lower indebtedness. Thus, a new era in the financial markets is looming.

From my own point of view, there are several areas that might be affected as a result of the turmoil we experienced recently.

Regulation

Because monetary policy alone could not stabilise the imbalances (by lowering the interest rates), we will, perhaps, witness some more government intervention, when financially, legally and politically feasible. I think financial/ housing markets will be based on more stringent regulations. I believe there is a need to limit increases in indebtedness and irrational lending. The affordability measure can be used as a tool to regulate housing and credit markets. For example, Financial Service Authority and Financial Stability in Denmark can "standardize" the concept/measures of housing and credit affordability.

Prolonged downturn on the housing market

The financial growth was partly driven by the boom in asset prices, on the housing market particularly. And another way around: financial growth boosted the asset prices. However, because of unsustainable leverage and coming regulation (Basel 3), banks will not be able to grow as they did in the last decade. The industry is likely to stagnate or shrink in the next few years. In the case of stagnation on the financial market, the housing asset prices are unlikely to increase. Reductions in lending (along with significant rises in unemployment or interest rate) generate further risks for the housing market. Consequently, we will not see an economic upturn before the whole financial market and housing market will stabilize.

In bust times it can be a solution to decrease the level of the foreclosures or increase the housing demand. This can be done by providing subsidy/insurance for owner-occupiers with a housing burden problem. The affordability measure can be used to identify the subsidy level/insurance

(hypothetically) to low-income home-owners (by measuring the gap between minimum required and actual cost, as I did in my model).

Risk assessment

I expect that banks/analysts will assess risk in a "realistic way", based on actual fundamentals (not on the over-optimistic expectations). Perhaps new models of risk assessment will be derived. The risk assessment of housing markets can be done by the affordability approach. As a result, the housing affordability problems can be noticed at the initial stage of housing instability. Studies can measure the pace of increase in gap between minimum required and actual income, and also compare the growth rates of income to the growth rates of housing prices. The results can be published by special, publicly available reports (for example, by the National Banks).

Speculation

I hope, the last financial crisis contributed to a better understanding of the danger of speculation and of the risks of housing market investment. The market achieved a clear comprehension of the underlying threats posed by the market to a large number of households and financial institutions.
I believe, housing market should be seen as "a necessary", not as "a speculative asset" (or a least a combination of the two). Therefore, lenders should educate first-time buyers on the real housing-related costs and how it affect households' budget.

Housing instability

I think there is a need to "stabilise" the imbalances on the housing market by reasonable housing pricing. The average house/flat should appear affordable to an "average" household (at least to a larger group of population). Consequently, the pricing of new built housing (average) can be based on "aggregate" affordability measure. Also, the affordability approach can be useful for the building industry in predicting how profitable it would be to build and sell new homes in a given area.

I am convinced that the prudent assessment of housing affordability and its applications into the practicalities of the different housing markets, with the recommendations I have outlined, are necessary to measure/control/stabilise the imbalances between incomes, credit conditions, costs of housing on one side, and housing demand and prices on the other.
I believe the concept of housing affordability can be transferred to the above mentioned contexts. Then, the crisis of the housing market created by the financial crisis and the problems of housing affordability will gradually disappear.

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https://www.retsinformation.dk/Forms/R0710.aspx?id=27608-

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http://www.skat.dk/getFile.aspx?Id=60926

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(http://www.thehdmt.org/indicators/view/122)

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http://en.wikipedia.org/wiki/Affordable_housing

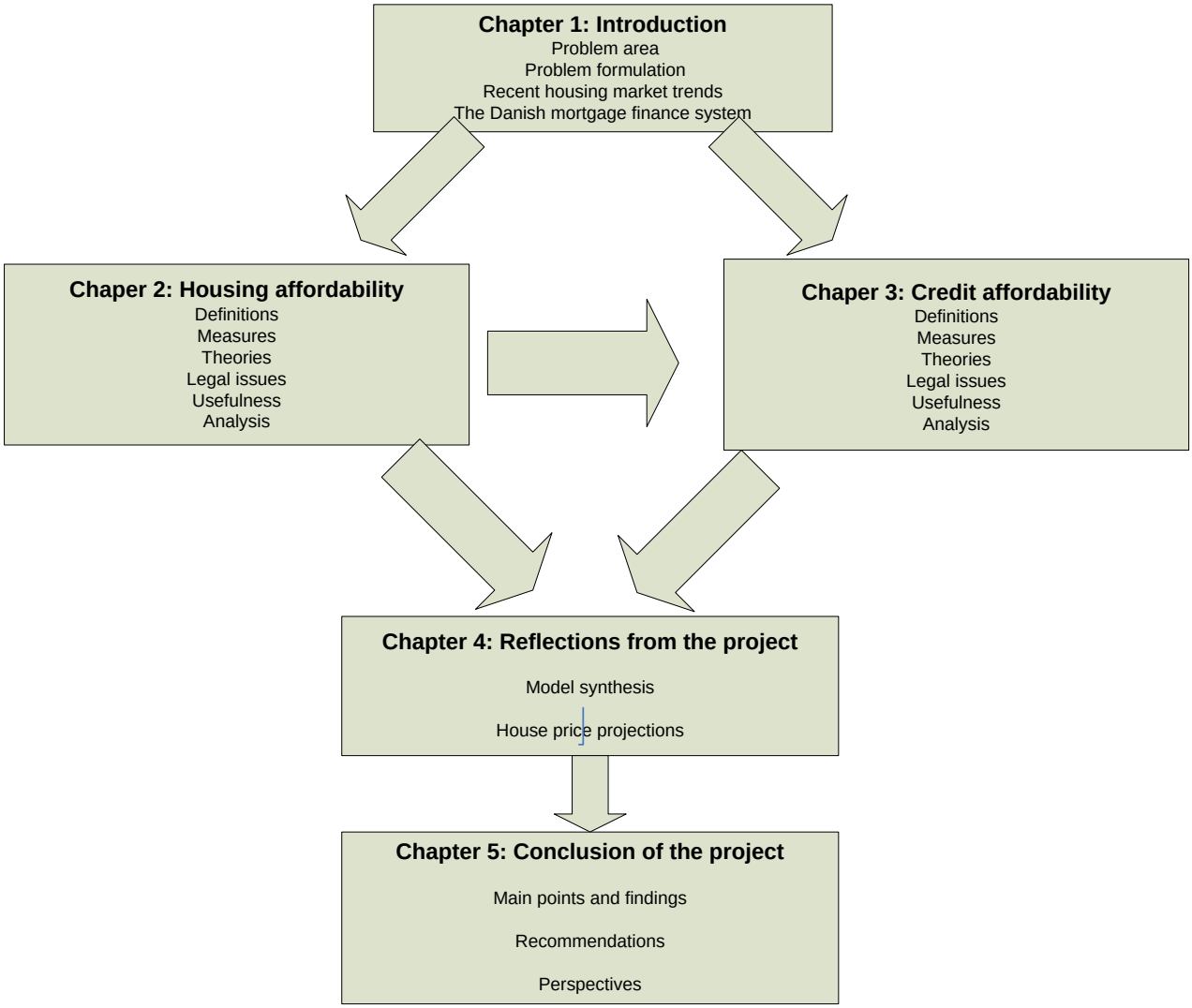
Appendix A

Tables, Figures and Extended Analysis

Olena Denysyuk

Table of Contents- Appendix A

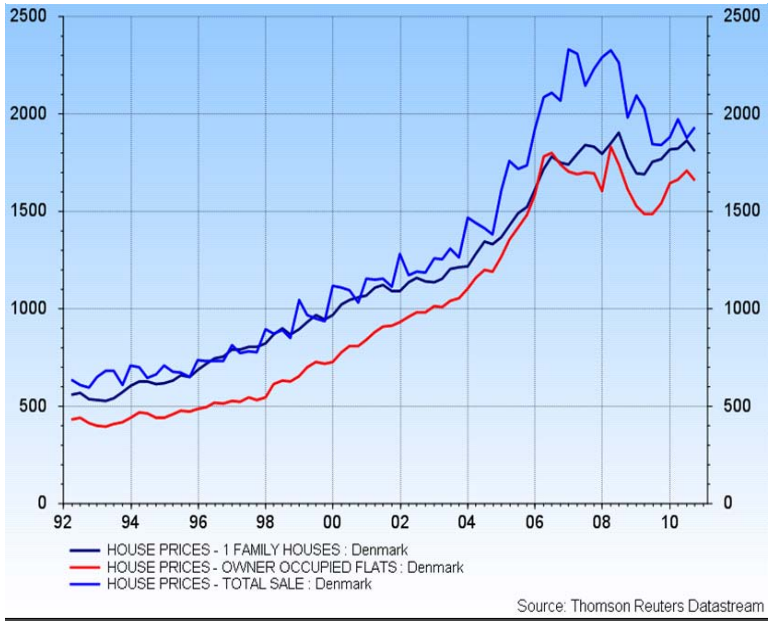
Appendix 1A: Structure of the Project



Source: own creation

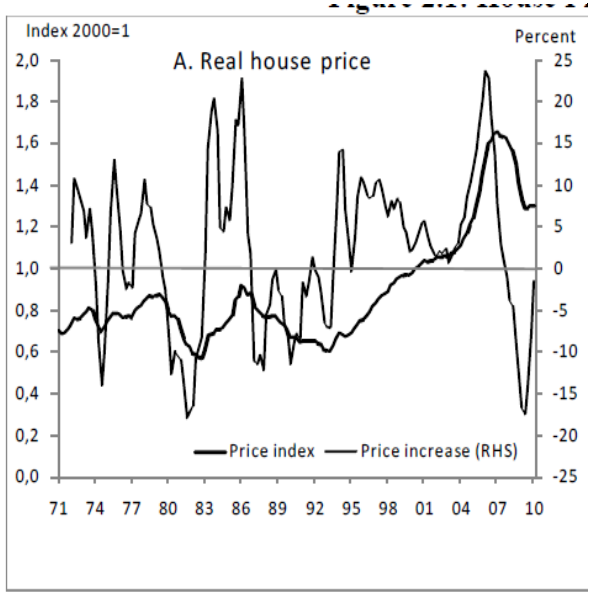
Appendix 2A: Housing Prices Developments in Denmark

Figure 1 Average price of owner occupied dwellings, Denmark, 1992-2010



Source: The Association of Danish Mortgage Banks

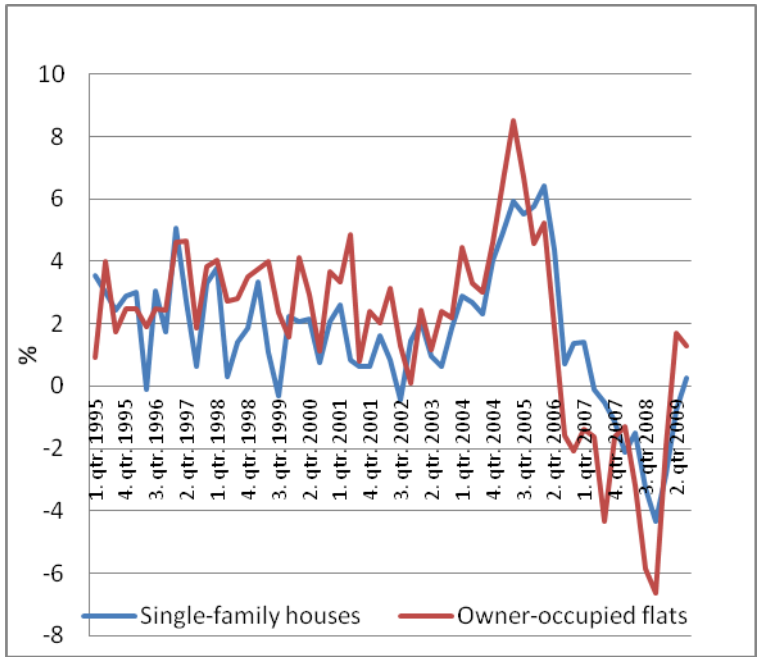
Figure 2: Real housing price index developments during 1971-2010



Source: The National Bank, Statistics Denmark and Danish tax authorities

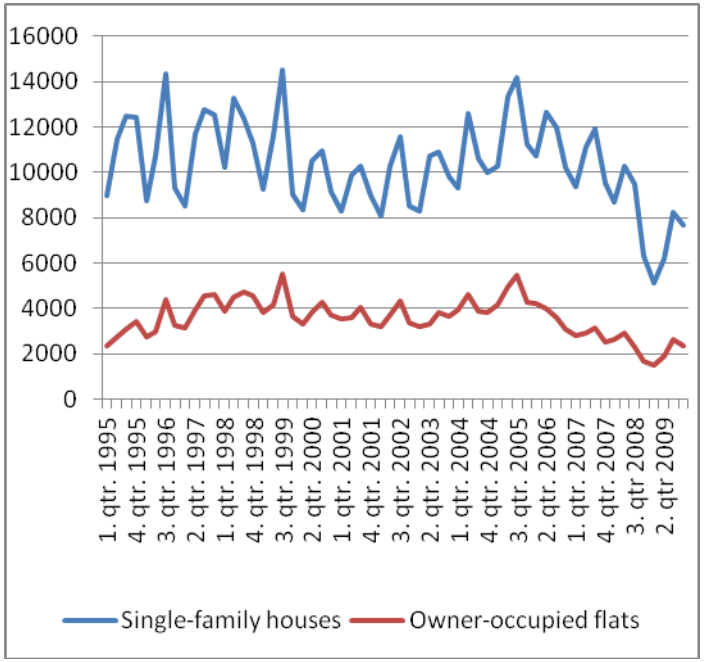
Methodology: The property price statistics compiled by the Association of Danish Mortgage Banks are based on reports from the mortgage banks that grant loans to owner-occupied homes. The basis for their reports is the mortgage loans paid to the borrowers. At present, the mortgage banks that report data are BRFkredit, Nordea Kredit, Nykredit (including Totalkredit) and Realkredit Danmark.(www.realkreditraadet.dk)

Figure 3: Quarterly growth rate of average sqm prices of owner-occupied dwellings,
Denmark



Source: The Association of Danish Mortgage Banks

Figure 4: Number of transactions of owner-occupied dwellings, Denmark

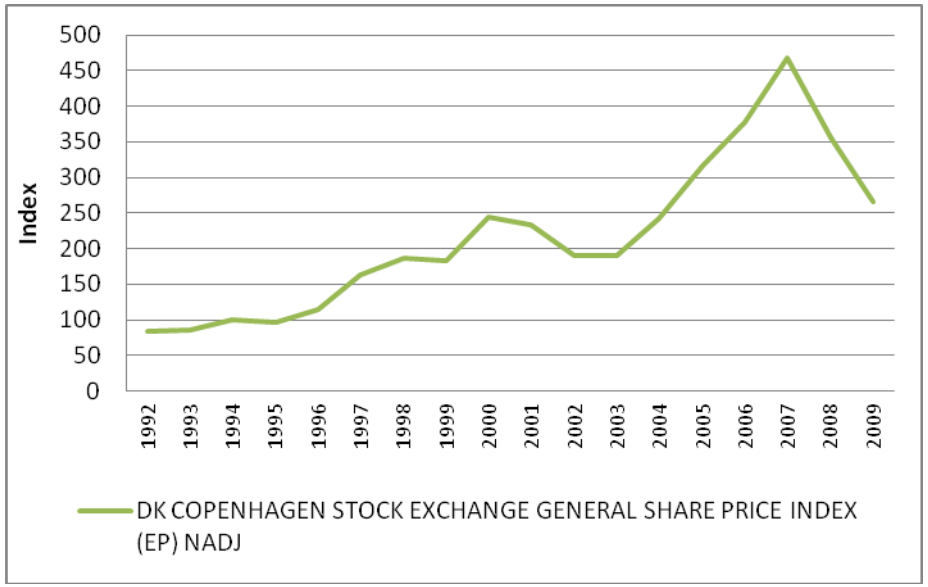


Source: The Association of Danish Mortgage Banks

Appendix 3A: Economic Indicators in Figures

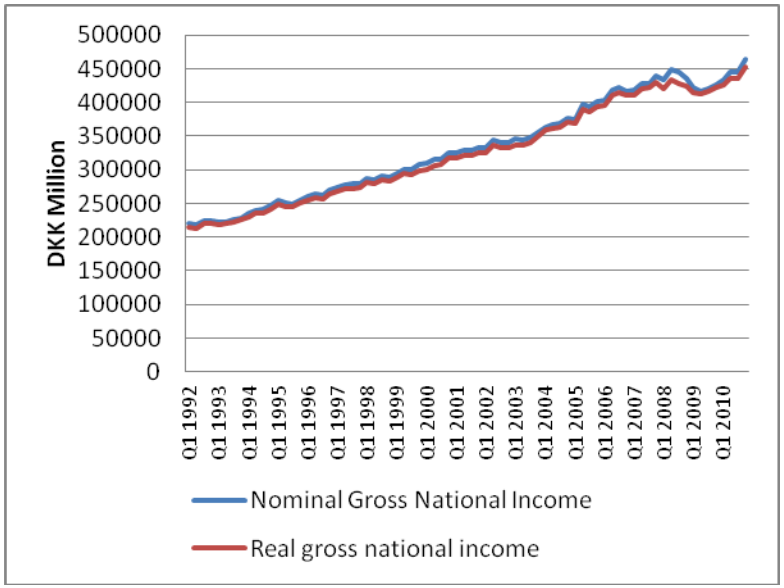
(Source to all tables: Danmarks Statistics)

Figure 5: Copenhagen Stock Exchange share price index development; 1994=100



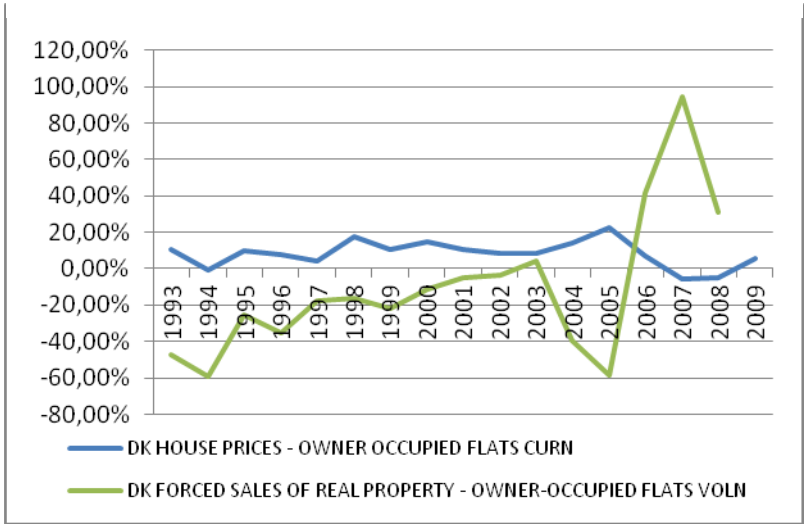
Source: DataStream

Figure 6: Aggregate income development, Denmark



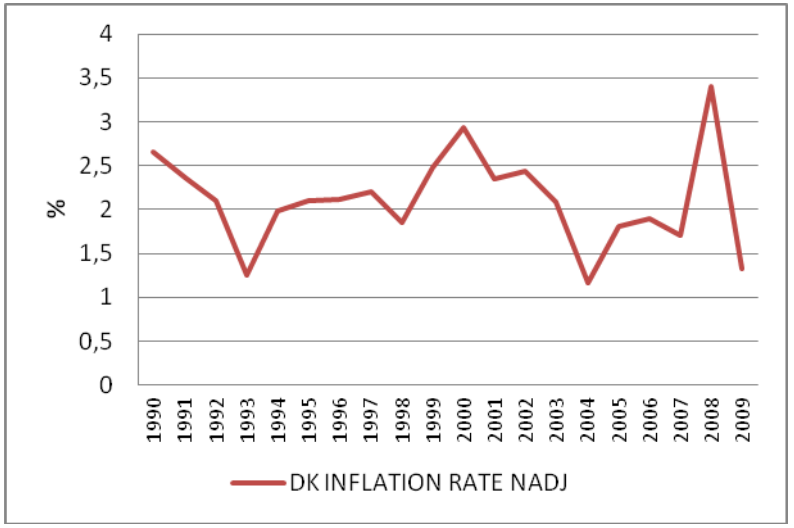
Source: Danmarks Statistics

Figure 7: Growth rates in housing prices and forced sales of owner-occupied flats, Denmark



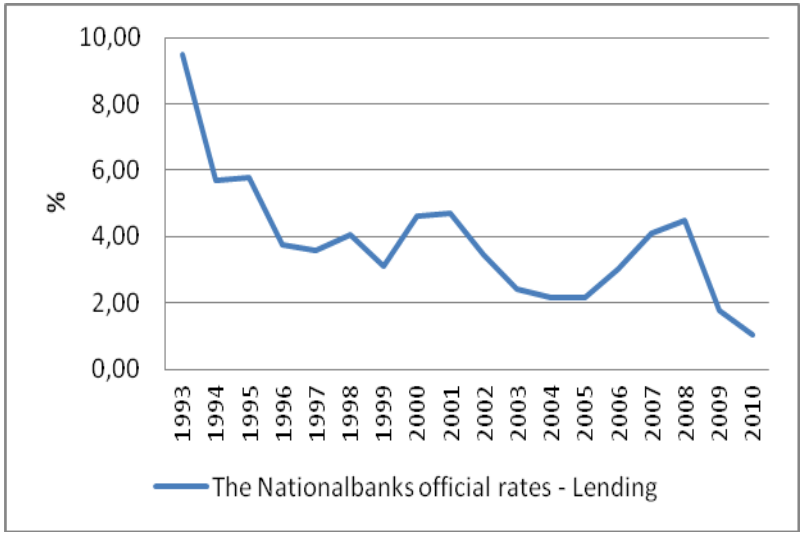
Source: Danmarks Statistics

Figure 8: Inflation rate, Denmark



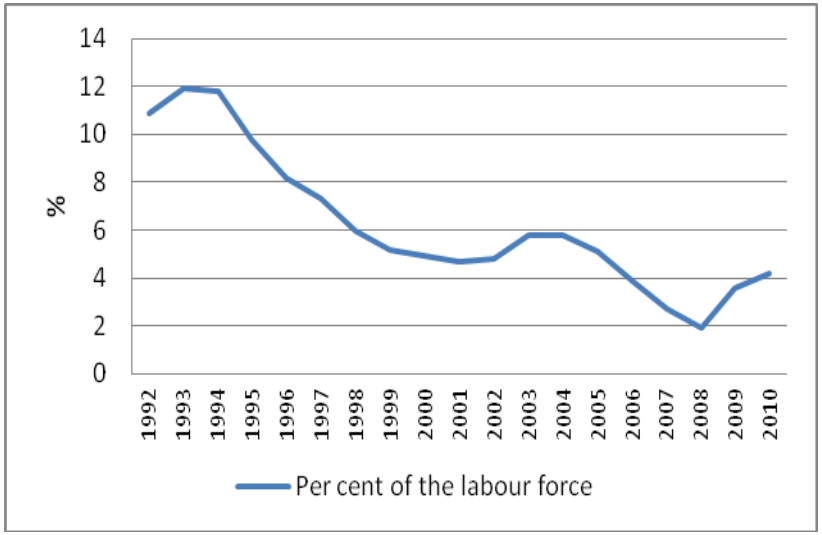
Source: Danmarks Statistics

Figure 9: Interest rate, Denmark



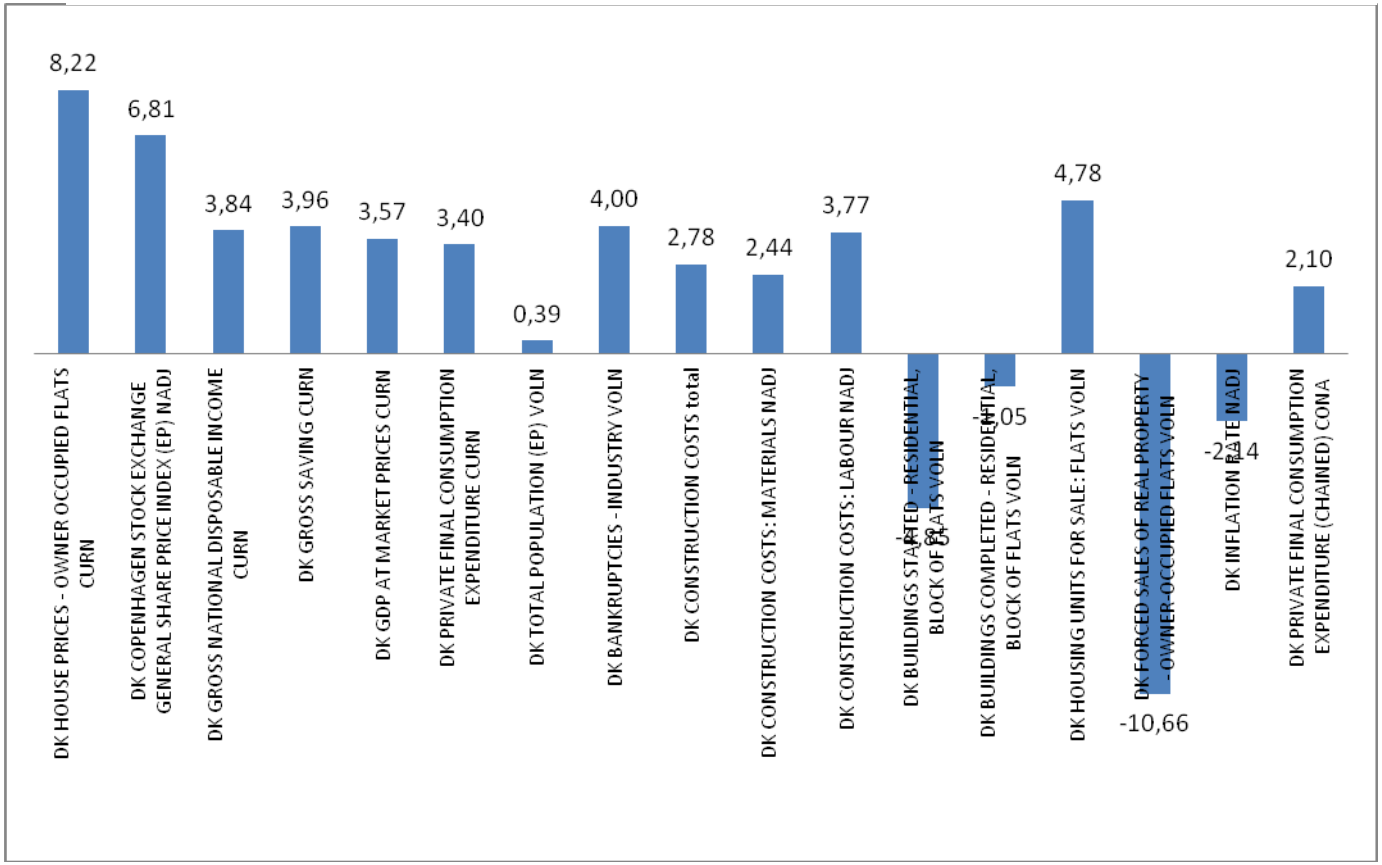
Source: Danmarks Statistics

Figure 10: Unemployment rate, Denmark



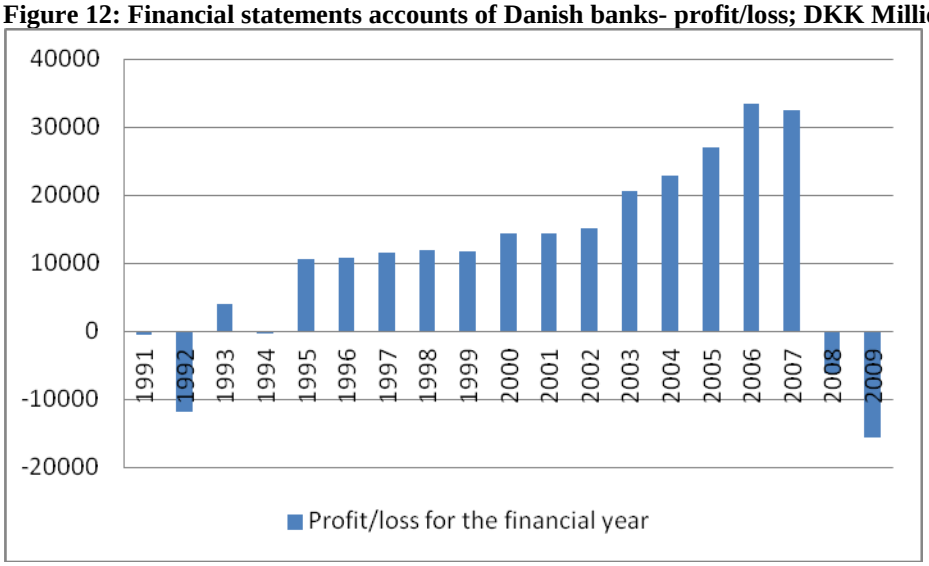
Source: Danmarks Statistics

Figure 21: Average growth rates of selected economic indicators, 1993-2009, Denmark



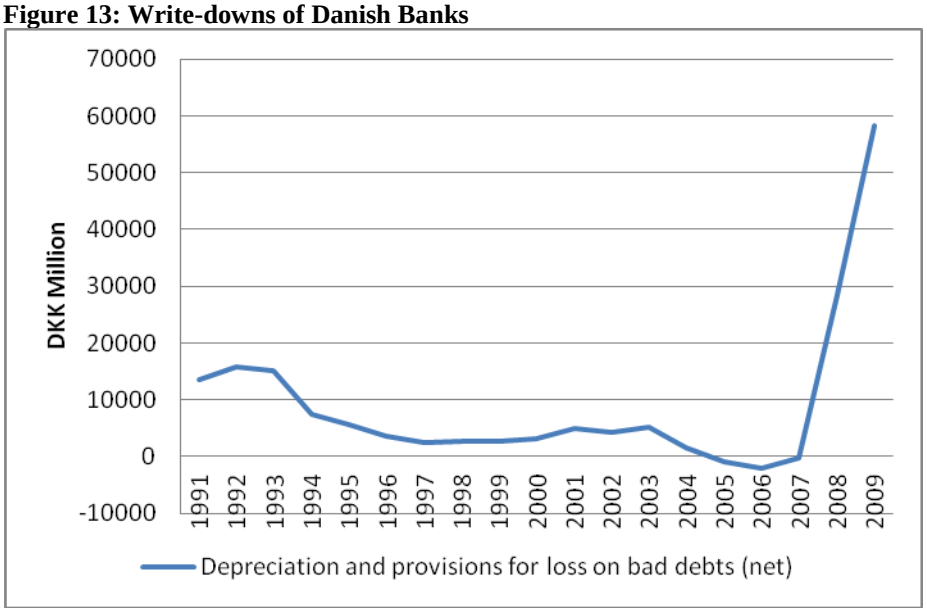
Source: DataStream, Danmarks Statistics and own calculations

Figure 12: Financial statements accounts of Danish banks- profit/loss; DKK Million



Source: Danmarks Statistics

Figure 13: Write-downs of Danish Banks



Source: Danmarks Statistics

Appendix 4A: Housing Affordability Measures- a Summary Table

Approach	Measure, explanation and its use	Advantage	Disadvantage	Reference
Relative—changes in the relationship between summary measures of house prices or costs and household incomes	• Aggregate house price/ Aggregate income (price to income ratio) • Aggregate house price/ Aggregate income per capita A typical home is defined as "the national median-priced, existing single-family home," and typical family is defined as "one earning the median [gross] family income as reported by the national statistics Indicator of housing affordability measures whether or not a typical family could qualify for a mortgage loan on a typical home	• Used widely by the mortgage lending and real estate industries to assess the affordability of the residential sales market for potential homebuyers. • It shows how far over or under-qualified the typical family is • Specifies what percentage of the needed income a family has in order to qualify for a mortgage on a median-priced home. • Specify the level of housing prices at a given income level • It is relatively simple to compute, as it only needs two variables	• Does not assess how many and which kinds of households can and cannot afford those properties that are for sale. • Does not distinguish between flat owner-occupation and house owner- occupation • Does not consider mortgage interest rates • It does not consider housing quality, location, or neighborhood quality • It does not take into account total housing costs including property taxes, insurance, utilities and interest rate • Does not take account of any changes in, for instance, the income situation as a result of unemployment in the following years	National Association of Realtors (NAR) and the Joint Center for Housing (www.realtor.org-housing affordability index) www.Rabobank.con(Dutch -Housing Market Quarterly) Stone (2006)
Subjective—whatever individual households are willing to or choose to spend	Since households are presumably rational utility-maximizers, every household is by definition paying just what it can afford for housing Some households may live in undesirable conditions; others may have low incomes that give them few choices; but they all make the choice that is best for them within their constraints.	• Households make the choice that is best for them within their constraints • Includes quality and physical standards of housing	• Has no generalizable meaning; it is neither rationally possible nor socially desirable to establish a normative standard of affordability other than individual choice. • Individual choices cannot be measured on aggregate level	Stone (2006) Lerman and Reeder (1987) Thalmann (1999, 2003)

Family budget—monetary standards based on aggregate housing expenditure patterns	Summary measures of what households in the aggregate actually spend for housing (or not for housing) in relation to minimum standards for consumption	• The budget standards approach involves specification of a market basket of essential items. Data for housing, food, and most other items in many cases in publicly available	• Although every household has its own unique conditions, therefore it is difficult to come to a conclusion what is a real minimum standards for consumption	Jewkes and Delgadillo (2010)
Ratio—maximum acceptable housing cost/income ratios	A rule of thumb: a housing became unaffordable when associated housing related cost exceed 30 per cent of income disposable for example: If the affordability index is 100, this means that for an average household income and an average priced house, the gross monthly burden is 30% of gross income. If the affordability index exceeds 100, then the gross monthly burden is less than 30% of gross income, and vice versa (www.rabobank.com)	• It asserts that if a household pays more for housing than a certain percentage of its income, then it will not have enough left for other necessities. • Has shaped views of who has affordability problems, the severity of problems, and the extent of the problems • Is easy to compute and simple to comprehend • Represents different measures of the affordability spectrum (not only measures housing price in relation to income, but also includes different housing related cost	• Yet despite its widespread recognition and acceptance, there is no theoretical or logical foundation for the concept or the particular ratio or ratios that are used. • Does not include home appreciation value and increases in household utilities	U.S. Department of Housing and Urban Development Measure Glaeser, Gyourko (2008) Stone (2006) Czischke (2009) Consumer Affairs Directorate (2001, 2003) www.Rabobank.con(Dutch- Housing Market Quarterly)
Residual income approach — normative standards of a minimum income required to meet non-housing needs at a basic level after paying for housing	Housing is affordable for the household if residual income after the subtracting the minimum cost of **necessary non-housing goods and services is** adequate to cover the cost or a new dwelling, including the down payment and periodic debt service	• The appropriate *indicator* of the relationship between housing costs and incomes is thus the difference between them—the residual income left after paying for housing • Derives the minimum required budget that is applicable in the household and aggregate levels • Clear distinction between cost items	• Since it measures first- time buyers housing affordability, there is uncertainty in forecasting the level of future housing-related cost, such as cost of maintenance and repair • Does not include macro- economic variables	Stone (2006) Yang,and Shen (2008)

Housing cost burden	Measure all housing cost in relation to disposable income	• All housing-related cost (tax, repair, etc) development included, thus, measures real housing affordability	• Measure housing affordability for a modelized family • Does not take into account the demographics	ww.nykredit.dk (boligbyrde)
Credit affordability	Interest payments- to- income	• Take into account the availability of credit and its cost into housing prices equilibrium	• Under-estimates other housing-related cost	De Vries , Boelhouwer (2009)
National Low Income Housing Coalition Housing Wage Measure	Calculate the Fair Market Rent (FMR) and the needed hourly wage to afford weekly/monthly housing- related cost.The housing wage is the hourly income of an individual working 40 hours per week for 52 weeks necessary to pay 30 percent of total annual income on housing.	• geared specifically toward renters • Housing Wage are calculated based on paying no more than 30% of income for total housing costs (NLIHC, n.d.). • Highlights local discrepancies in wages and housing costs.	• It is not helpful in determining the housing affordability situation other income sources are under- estimated • Not applicable in Denmark because of rent regulation	The National Low Income Housing Coalition (NLIHC)(http://www.thehdmt.org/indicators/view/122- Housing wage as a percent of minimum wage

Source: my own production

Appendix 5A: Efficient Market Hypothesis Assumptions

Neoclassical economics is a term variously used for approaches to economics focusing on the determination of prices, outputs, and income distributions in markets through supply and demand, often mediated through a hypothesized maximization of utility by income-constrained individuals and of profits by income-constrained firms employing available information and factors of production, in accordance with rational choice theory. (Wikipedia.org)

- The economic framework of the owner-occupied housing market may be typified as a neoclassical regime. Neoclassical economic theories refer to the utility of a product. In a competitive market, house price is the result of interacting demand and supply (Girouard *et al.,* 2006a). Factors influencing these two entities are usually called fundamentals or the underlying determinants that affect house prices. Factors such as disposable income, interest rates, and demographic development influence demand; factors affecting supply, such as the price of land and the impact of building costs, influence the availability of dwellings. These 'drivers' may influence the house price in the short-term, the medium-term, and/or the long-term.

Modern Finance and Efficient Market Hypothesis (EMH)

- In the modern finance framework, rational agents make decisions based on the best alternative and there are no emotions involved. A security's price equivalent its "fundamental value" that equals the expected sum of cash flows discounted by risk- free rate (or the expected return from similar investments). Agents form their expectations of future cash flows based on *all available information on the market*. The information is public and, *markets are efficient*. That is, one cannot consistently achieve returns in excess of average market returns on a risk-adjusted basis, given the information publicly available at the time the investment is made.
- So, all information is incorporated into security and therefore, the prices are correct.
- If EMH holds then there is no arbitrage opportunity; the only agents with superior information (or excellent trader skills) can beat the market. Competition between traders (not noise traders) ensures that prices very quickly reflect a fair interpretation of all relevant information.To value stock, investors apply traditional valuation models: CAPM, Consumption CAPM model; Price-Dividend Ratio, etc.
- According to modern finance, the recent prices reflected the economic fundamentals and other relevant information from the market.
- The critical point from this approach is that it was difficult to distinguish rationality from irrationality in investor's decision making process, especially in a recent boom stage. High investment and consumption was an extensive explanation for high stock prices which was related to high expected earnings (generated cash flows) and increases in productivity. A higher level of stock prices relative to corporate earnings and resent consumption boom did not seem unreasonable before the collapse.
- If EMH holds, the *markets are perfect*; there *cannot be bubbles* on the security market. Other factors which are outside the scope of EMH must explain the bubbles. The quality of judgment is the most critical factor in asset valuation (De Bondt, 2003), which is depended on the investor's rationality (Shiller, 2005).
- Availability and transparency of information, media, and other factors are the critical point in asset valuation and forming expectations. Therefore, we must turn to other models, which can better explain investor's judgment formation.
- There are three major versions of the hypothesis: "weak", "semi-strong", and "strong". Weak EMH claims that prices on traded assets (*e.g.*, stocks, bonds, or property) already reflect all past publicly available information. Semi-strong EMH claims both that prices reflect all publicly available information and that prices instantly change to reflect new public information. Strong EMH additionally claims that prices instantly reflect even hidden or "insider" information. There is

evidence for and against the weak and semi-strong EMHs, while there is powerful evidence against strong EMH.

In **weak-form efficiency**, future prices cannot be predicted by analyzing prices from the past. Excess returns cannot be earned *in the long run* by using investment strategies based on historical share prices or other historical data. Technical analysis techniques will not be able to consistently produce excess returns, though some forms of fundamental analysis may still provide excess returns. Share prices exhibit no serial dependencies, meaning that there are no "patterns" to asset prices. This implies that future price movements are determined entirely by information not contained in the price series. Hence, prices must follow a random walk. This 'soft' EMH does not require that prices remain at or near equilibrium, but only that market participants not be able to *systematically* profit from market 'inefficiencies'. However, while EMH predicts that all price movement (in the absence of change in fundamental information) is random (i.e., non-trending), many studies have shown a marked tendency for the stock markets to trend over time periods of weeks or longer and that, moreover, there is a positive correlation between degree of trending and length of time period studies (but note that over long time periods, the trending is sinusoidal in appearance). Various explanations for such large and apparently non-random price movements have been promulgated.

The problem of algorithmically constructing prices which reflect all available information has been studied extensively in the field of computer science. For example, the complexity of finding the arbitrage opportunities in pair betting markets has been shown to be NP-hard.

In **semi-strong-form efficiency**, it is implied that share prices adjust to publicly available new information very rapidly and in an unbiased fashion, such that no excess returns can be earned by trading on that information. Semi-strong-form efficiency implies that neither fundamental analysis nor technical analysis techniques will be able to reliably produce excess returns. To test for semi-strong-form efficiency, the adjustments to previously unknown news must be of a reasonable size and must be instantaneous. To test for this, consistent upward or downward adjustments after the initial change must be looked for. If there are any such adjustments it would suggest that investors had interpreted the information in a biased fashion and hence in an inefficient manner.

In **strong-form efficiency**, share prices reflect all information, public and private, and no one can earn excess returns. If there are legal barriers to private information becoming public, as with insider trading laws, strong-form efficiency is impossible, except in the case where the laws are universally ignored. To test for strong-form efficiency, a market needs to exist where investors cannot consistently earn excess returns over a long period of time. Even if some money managers are consistently observed to beat the market, no refutation even of strong-form efficiency follows: with hundreds of thousands of fund managers worldwide, even a normal distribution of returns (as efficiency predicts) should be expected to produce a few dozen "star" performers

Source: Wikipedia.org; Fama, 1970; DeBond, 2003 and own production

Appendix 6A: Housing Prices' Driving Forces- a Summary Table

Housing price valuation approach/ methodology	Variables	Explanations/Results	Reference
Equilibrium Determined by Supply and Demand (Neo-classical and Modern Finance)			
Efficient Market Hypothesis (EMH): the price of a financial asset reflects all available information that is relevant to its value Measures: Multifactor modeling Regression analyses	9/10 of the increase since 1993 is explained by fundamentals (Wagner, 2005)	From Wager's (2005) analysis: Contributions from general economic development (55%) Increase in disposable income (59 %) Decrease in real interest rate before taxes (33%) Increase in value in interest deduction (-21%) Increase in amount of potential first buyers (26 %) New houses (-26%) Changes in taxes on properties (8%) Non- explained factors (19%) (values in parentheses shows the contribution to housing price)	Wagner (2005) Meen (2002 Skaarup and Bødker (2010) Denmark, Danmarks Nationalbank (2003) Miles & Pilonca (2008)
	Supply variables: construction cost, labour cost	Price reactions to demand shocks – such as those produced by shifts in interest rates – fundamentally depend on supply responses. If supply is perfectly elastic, house prices will not durably deviate from marginal production costs, which include construction costs, land costs and a normal profit margin of the homebuilder. If supply is inelastic, demand shocks generate price increases, which can be amplified by backward-looking expectations and lead to the development of bubbles.	Glaeser *et al.*, 2008.
Equilibrium	Price- to- income relationship	It is expected that changes in income influence the demand for housing and thus, prices (see "Theoretical Argumentation and Empirical Evidence in the report).	See table "Empirical Evidence on Price-Income" relationship
	Price- to- rent relationship	The measure is akin to price-to-earnings multiple for stocks. This metric is intended to reflect the relative cost of owing versus renting. Therefore, it the price of renting is increasing/declining more households will choose to live in owned/rented home, influencing the housing demand and prices.	Himmelberg et al (2005)
Financial Markets Affects			
Balance sheet channel (no such a model that measures it affect, however, can be used as variables in multi-factor models)	Write- offs	In good time the risks and therefore write- downs are undervalued, thus, increased lending activities and feeding the asset prices. In bad time the associated risk is overvalued, thus, pushing prices further down.	Danmarks Nationalbank (2008)
	Leverage and de-leverage of financial institutions (pro-cyclicality in leverage)	Leverage: As asset prices raise, leveraged financial institution's capital rise relative to their regulatory requirements, thus, banks buy more assets. The rise in leverage feeds back into asset price increase, encouraging more and more leverage De-leverage: in the falling markets (and declined value of assets), financial intermediaries need to limit their leverage in order to match with liabilities and capital requirements. When banks limit their leverage, they sell assets. That lowers the prices of securities, which puts further incentive on balance sheets leading to further sales. It sparks further reduction in asset values.	Muellbauer and Murphy (2008)

	Collateral /Capital Adequacy	When housing wealth is used as collateral, it provides important determinants of private sectors' borrowing capacity. At a higher house price, households can pose more as collateral, banks, therefore, are willing to lend more. In times of housing boom and increased housing wealth, collateral ratio raise. Banks are willing to lend more when using housing as collateral. The same process goes in the opposite direction when th home prices fall. When asset prices fall, collateral ratio falls. Banks then cut on lending.	Akerlof and Shiller (2009)
Interest rate	Interest rate developments	See table "Empirical Evidence on Interest Rate and Housing Prices	
Credit availability	Tightening and loosening of credit standards	See chapters "Credits and Housing prices" and "Empirical Evidence on Bank Credit and Property Prices" in the report.	
Mortgage market developments	Extension of loan terms Development of interest- only loans Increased loan- to-value ratio Housing equity withdrawal Subprime market Securitization Increased credit supply	Securitization: Because of securitization, banks were willing to take more risk and increase borrowing even to creditworthless customers. Development of interest only loans: Decreased interest payments (improved credit affordability) results in higher credit/ housing demand, and therefore, housing prices. Extension of loan terms: as price increases made housing less affordable, lenders have tended to lengthen the repayment period of mortgages. Mortgages with terms of up to 50 years are now available in countries such as France, Spain and the United Kingdom.	André (2010) Lunde et al.(2008a) Danmarks Nationalbank (2011)
	Deregulation and mortgage innovations	Deregulation and mortgage finance innovations have significantly reduced borrowing constraints on households in many countries. As house prices went up, reducing the affordability of housing, financial innovations were used to loosen the financial constraint of households, especially by lowering initial repayments. Such innovations have generated two problems. First, while on an individual basis financial arrangements offering households easier access to credit might be desirable, at the aggregate level they boost demand and hence put further pressure on prices. Second, many financial innovations increase the vulnerability of households through different channels. Delaying the repayment period exposes households to increased interest rate risk. Furthermore, it is likely that not all households fully understand the risks involved in taking, for example, variable rate or interest-only loans. Many borrowers tend to choose mortgages with the lowest repayments, at the expense of higher risk (Lunde *et al*., 2008a). The problem is exacerbated in the case of more sophisticated products, such as those offering teaser rates.	André (2010) Lunde et al.(2008a)
Asset Pricing Approach			
Discounted cash flow models	The rental value (equivalent to future cash flows) Interest rate (discount factor)	Net Present value theory (discounting expected free cash flow by free interest rate) would asses real estate investment as a return on investment (the returns are to be proportional to GDP) plus "dividend" that would take the form of the value of crops that could be grown on the land, the rental value of the land, or other possible benefits that could accrue to the owner while the land is	Akerlof and Shiller (2009. p 153)

	The value of crops (for agricultural property assessment)	still owned. The assumptions on future cash flow (for example, rents) are based on expectations of future income, affordability, etc. The future cash flows are then discounted by the interest rate. Therefore, a decline/increase in interest rate will result in higher/ lower present value of the property.	
Risk- Return Correlation	Housing volatility Portfolio Stock Market (Financial Wealth Effect) Asset Allocation	Speculative mania led increase in asset prices through allocation of capital in equity. Investors re-shifted portfolios preferences towards equity, placing upward pressure on prices even when unrelated to fundamentals. Thus, portfolio preferences determined the asset level. With higher preferences on equity (housing), investors were willing to pay higher price for asset (housing).	Case, Quigley and Shiller (2006)
User- cost (arbitrage assumption)	Mortgage cost The sum of maintenance costs A risk premium The expected capital gain (the expected rate change of house prices The means of housing purchase The risk characteristics of housing (measured by the conditional covariance between house values and the marginal utility of income The extend of credit restrictions Transaction cost (the cost of buying a house)	A change in any of these factors will affect the demand and supply of housing and correspondingly housing prices. In Denmark, the average user costs of holding a house declined steadily between the mid 1990s and mid 2000s as a result of declining mortgage rates, increased use of adjustable-rate mortgages, and falling property-related tax rates. A phased reduction in the mortgage rate income tax deductibility (from 46 percent in 1998 to 33 percent in 2001) offset some of the forces lowering housing user costs. Nevertheless, lower after tax real mortgage rates improved household's debt service capacity and user costs are now only a third of what they used to be during the 1990s. (Skaarup, Brødker, 2010).	Himmelberg et al (2005), Miles (1994), Lunde (1998a)
Macro- Economy Effect			
Wider economy in general: correlations	Unemployment Residual Investments Bankruptcies	Consumption: The estimated elasticity based upon US states, 0,034- 0,054, suggest that a 10 per cent change in housing wealth is associated with a 0,3 to 0,5 per cent change in aggregate consumption	Case & Quigley (2008)

	Forced sales (Foreclosure) Consumption	Foreclosure *(the process by which a home-owner loses their home due to non-payment of mortgage)*. During the years of the rapidly rising housing prices, delinquency and foreclosure rates declined rapidly, which send even more incentives to lend into housing market and pushing housing prices up. However, foreclosures happen more frequently in times of housing downturn. When a borrowers loan exceed its housing value (the owners private equity is then negative meaning that mortgage loan on housing is worth more than the home), he can no longer use the option of a pre-payment. Moreover, if he is no longer employed (due to higher unemployment rate in recession times), he is no longer able to meet his mortgage obligations. Then banks have right to sell his house. This process accumulates houses for sale on the housing market and puts pressure on prices.	Taylor (2009)
		Residual Investments During the expansion of the 1990s, residential investment generally expanded at a moderate pace. But during the latest expansion, there was a housing investment boom in many countries, particularly the United States, Canada, Denmark, Ireland, Norway and Spain. Measured as a share of nominal GDP, long-term averages for housing investment are typically in the range of 4 to 6%. At the peak of the cycle in 2006, this ratio reached more than 9% in Spain and 14% in Ireland. So, increased interest in residential investments lead to increased housing demand, and therefore, housing prices	André (2010)
Other Factors			
Individual Characteristics	Neighborhood characteristics Location Convenience Year of building	These factors effect housing prices level, however, difficult to incorporate on the aggregate level.	Wendt (1994)
Demographics	Population Age Immigration Environmental restrictions	Changed demographic trends, for example, increased proportion of first- time buyers (30- 39 year old) of a general population, as well as increased population, migration result in increased housing demand, and therefore, housing prices.	
Other Schools			
Behavioral Finance	Risk perception Expectations Beliefs Backward- looking	See chapter " Housing price formation under behavioral finance assumption" in the report	Shiller (2005, 2007, 2009) Akerlof and Shiller (2009) De Bondt (2003)
Currency School- The Monetarist approach	Extended Money Supply Bunk runs	Increased money supply increase interest in investments, which in tern, increases the possibility of price bubbles. Taylor contends that "monetary excess were the main cause of the recent housing	Taylor (2009a) Schwartz (1987)

	Inflation	boom and the resulting bust". Also, inflation leads to heightened risk in lending decisions, as uncertainty over future cash flows increase. Thus, there is a high demand for housing in times of high inflation as it is seen as a "protection" against the inflation.	
Debt- Deflation Theory of Great Depressions	Increased investments Increased indebtedness Decrease in real value of underlying debt while the value of asses increases	The upswing in business activities lead to an improved opportunities for profitable investments. This lead to increased fixed investment, as well as speculation in asset markets for capital gain. Velocity increases and lead to raising prices. Rising prices reduce the real value of outstanding debt, offsetting the increase in nominal debt, and encouraging further borrowing. This leads to a stage of "over-indebtedness". At some point some events may reduce willingness to borrow and invest. For example, raise in interest rate, a war, a new law, etc. Then agents will need liquidity.When agents need liquidity, distress selling occurs. Distress selling leads to falling prices, bank deposits declining as loans are withdrawn. Foreclosure, need for new capital to pay off previous debt. Deflation increases the real value of outstanding debt. All this triggers the crisis.	Fisher (1932, 1933)
Debt and Financial Fragility	Euphoria Speculation	See chapter "Theoretical Evidence" in "Credit Affordability" part in the report	
		Policies and Regulatory Actions	
Monetary Policies Measure: Taylor Rule	Interest rate developments	A right monetary policy aims to keep prices stable. Thus, monetary policy can be used as an instrument to prevent bubbles.	Trichet (2003)
Quantitative Easing (QE)	Bond Rate	QE works mainly through two channels. First, when central banks buys government bonds the extra demand raises bond prices and lowers their yields. Lower interest rates stimulate activity elsewhere in the economy. Second, when banks sell their bonds to the central banks they get reserves (ie, deposits at the central bank) in return. They have an incentive to swap those low- yielding reserves to something with better returns, like shares or corporate bond. This lowers private borrowing cost and raises asset values, boosting wealth and spending.	*The Economist*, September, 4th, 2010)
Taxation	Property taxes Land taxes Tax shield (the deductable value of mortgage interests related to the main residence from personal income tax) Taxes on transactions	A variety of taxes, tax reliefs and subsidies affect the housing sector. Advantageous tax treatment of housing may also lead to over-investment in real estate and misallocation of capital, with negative effects on long-term economic growth Van den Noord (2005) demonstrates that, in the presence of backward-looking expectations, a tax system which subsidises homeownership tends to increase house price volatility. He shows that euro area countries with the highest subsidies for homeownership – Finland, Ireland, Netherlands and Spain – have the most volatile house prices	André (2010)

Source: my own production

Appendix 7A: Behavioral Finance Assumptions- Factor Influencing Decision- Making

Framing
The term *frame dependence* means that the way people behave depends on the way that their decision problems are framed.

Framing is a cognitive heuristic in which people tend to reach conclusions based on the 'framework' within which a situation was presented.

Overreaction
De Bondt (2003) argued that investors overreact to both bad news and good news. Therefore, overreaction leads past losers to become underpriced and past winners to become overpriced.

Money Illusion
Frame dependence also impacts the way that people deal with inflation, both cognitively and emotionally. This is the issue of *money illusion*. (Akerlof and Shiller, 2009)

Risk
An emerging topic of interest and exploration by researchers in the behavioral finance camp has been the assessment of an inverse (negative) relationship between perceived risk and expected return (perceived gain).

Selective thinking

Selective thinking is the process by which one focuses on favourable evidence in order to justify a belief, ignoring unfavourable evidence.

Noise

"...one way to think about noise is that it is the opposite of news. Rational traders make decisions on the basis of news (facts, forecasts, etc.). Noise traders make decisions based on anything else."

Momentum
"A common phenomenon in the three types of analyst recommendation studies is *momentum*. The stocks that get recomnended are those that have recently done well. In an important study Narasim Jegadeesh and Sheridan Titman (1993) document the existence of a momentum effect. Jegadeesh and Titman attribute this effect to the fact that investors underreact to the release of firm-specific information, a cognitive bias."

"In addition to this long-run tendency toward reversal of trends, there is a shorter-run weak tendency toward momentum, for stock prices to continue moving in the same direction"

Researchers have identified more ways to successfully predict security returns, particularly those of stocks, based on past returns. Among these findings, perhaps the most important is that of momentum, which shows that movements in individual stock prices over the period of six to twelve months tend to predict future movements in the same direction. That is, unlike the long-term trends identified by De Bondt and Thaler, which tend to reverse themselves, relatively short-term trends continue."

Overconfidence

People are overconfident. Psychologists have determined that overconfidence causes people to overestimate their knowledge, underestimate risks, and exaggerate their ability to control events. Does overconfidence occur in investment decision making? Security selection is a difficult task. It is precisely this type of task at which people exhibit the greatest overconfidence.

- Overconfidence is greatest when accuracy is near chance levels.
- Overconfidence diminishes as accuracy increases from 50 to 80 percent, and once accuracy exceeds 80 percent, people often become *under*-confident. In other words, the gap between accuracy and confidence is smallest when accuracy is around 80 percent, and it grows larger as accuracy departs from this level.

Discrepancies between accuracy and confidence are not related to a decision maker's intelligence

Bubbles
"...*speculative bubble*: a situation in which temporarily high prices are sustained largely by investors' enthusiasm rather than by consistent estimation of real value."
Shiller (2005)
A spike in asset values within a particular industry, commodity, or asset class. A speculative bubble is usually caused by exaggerated expectations of future growth, price appreciation, or other events that could cause an increase in asset values. This drives trading volumes higher, and as more investors rally around the heightened expectation, buyers outnumber sellers, pushing prices beyond what an objective analysis of intrinsic value would suggest.

The bubble is not completed until prices fall back down to normalized levels; this usually involves a period of steep decline in price during which most investors panic and sell out of their investments.

Underreaction

"In predicting the future, people tend to get anchored by salient past events. Consequently, they underreact."

"The underreaction evidence shows that security prices underreact to news such as earnings announcements. If the news is good, prices keep trending up after the initial positive reaction; if the news is bad, prices keep trending down after the initial negative reaction."

Speculation and Asset prices

Crux of speculative market view is that assets are purchased based on the **belief of future price appreciation**, implying that price movements are based primary on the balance of **public opinion** rather than objective fundamental (Evans Jr, 2003). The process of speculation is **debt- financed**, mainly by bank loans, which increases deposits, the money supply, and the price level. (Davis, 1992)

Source (http://www.behaviouralfinance.net/), Shiller (2005), DeBondt (2003)

Appendix 8A: An Example of House Sale Presentation (Salgsopstilling)

Adresse **Vestermarken 42, 4600 Køge** Sag nr. **10013282P** Dato **16-07-2007**

Kontantpris **4.345.000** Udbetaling **220.000** Brutto/md. **27.787** Netto/md. **22.618** v/ **33,78** %.

Bruttoudgift/ejerudgift 1. år	**Kontant**	**Finansieret**
Prioritetsydelser	**0,00**	**318.241,39**
Ejendomsskatter **2007**	**4.469,44**	**4.469,44**
Renovationsafgift inkl. tillæg	**3.068,75**	**3.068,75**
Antenneafgift	**2.187,50**	**2.187,50**
Rottebekæmpelse	**34,50**	**34,50**
Grundejerforeningskontingent	**1.500,00**	**1.500,00**
Forsikringspræmie	**3.948,00**	**3.948,00**
Bruttoudgift 1. år	**15.208,19**	**333.449,58**
Nettoudgift 1. år	**Kontant**	**Finansieret**
Fradrag (renter, bidrag)	**0,00**	**-256.155,55**
Skat/skattebesparelse heraf 1. år v/ **33,78** %	**0,00**	**-86.529,34**
Ejendomsværdiskat	**24.500,00**	**24.500,00**
Skat, overskud/underskud 1. år	**24.500,00**	**-62.029,34**
+ Bruttoudgift 1. år	**15.208,19**	**333.449,58**
Nettoudgift 1. år	**39.708,19**	**271.420,24**
Kontantbehov ved køb	**Kontant**	**Finansieret**
Kontantpris/udbetaling	**4.345.000,00**	**220.000,00**
Tinglysningsafgift af skøde	**27.500,00**	**29.400,00**
Stiftelses-/og overtagelsesomkostninger, jf. finansieringsforslaget	**0,00**	**0,00**
Omkostninger til berigtigelse af skødet, anslået	**7.500,00**	**7.500,00**
Ialt	**4.380.000,00**	**256.900,00**

Oplysning om brutto/netto udgift

Bruttoudgiften er lig med ejerudgiften første år. Ydelsen omfatter aktuelle ejerudgifter, som køber er forpligtet til at afholde som ejer af ejendommen. Nettoudgiften er lig med bruttoudgiften efter fradrag af den aktuelle størrelse af skattemæssige fradrag og med tillæg af ejendomsværdiskat. Brutto- og nettoudgiften omfatter ikke udgifter til energi, vand og andre forbrugsafhængige forhold. Endvidere omfatter brutto- og nettoydelsen ikke udgifter til løbende vedligeholdelse. I brutto- og nettoydelsen indgår en standardfinansiering. Da der er tale om en standardfinansiering vil den i visse tilfælde ikke kunne opnås, hvorfor brutto- og nettoydelsen i så fald kan afvige.

Standardfinansiering

Standardfinansieringen er udarbejdet ud fra følgende forudsætninger:
Kontant udbetaling på 5 % af den kontante købesum oprundet til nærmeste kr. 5.000 dog minimum kr. 25.000. Der optages et realkreditlån op til den maksimale lånegrænse for den pågældende ejendomskategori efter lov om realkreditlån og realkreditobligationer m. v. Løbetiden er 30 år. Lånet er et konverterbart obligationslån med fast rente, der afdrages over hele løbetiden efter annuitetsprincippet. Lånet er baseret på dertil hørende obligationer, hvis kurs er 100 eller nærmeste herunder.
For restkøbesummen udstedes et pantebrev. Pantebrevet er med fast rente og har en løbetid på 30 år. Der afdrages på lånet over hele løbetiden efter annuitetsprincippet. Lånet fastsættes til kurs pari og renten fastlægges som den effektive rente på realkreditlånet tillagt 1,5 procent point og herefter oprundet til nærmeste kvarte procent point.
Særlige oplysninger om standardfinansieringen:

Gæld udenfor købesummen

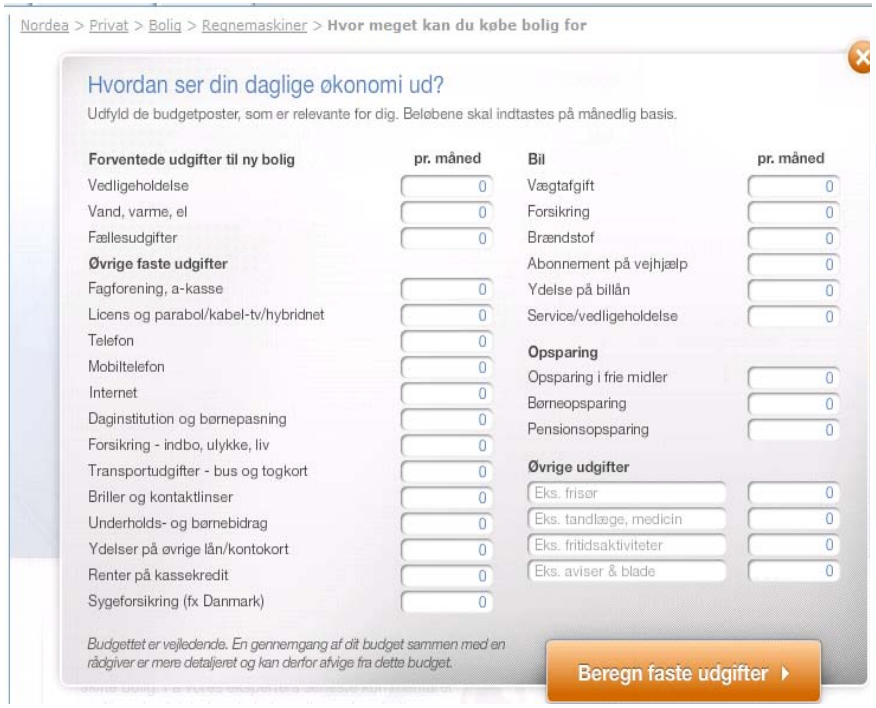
Ingen pr. overtagelsesdagen

Oplysninger om eksisterende lån

Långiver/art	Realkreditype	Restgæld	Obl.restgæld	Kontantværdi	Optaget i valuta	Rente Kont./pålyd.	1. års ydelse	Rest-løbetid	ÅOP	Saldo fradragskonto	Særlige overtagelsesvilkår	Garantistillelse	Kontantregulering
Nykredit KA	**Kontant**	**312.118**	**317.604**	**317.753**	**DKK**	**4,2264/**	**35.608**	**11,5**	**5,3**	**0,00**		**Nej**	**0**
TotalKredit OF	**Obligation**	**1.940.000**	**1.940.000**	**1.728.608**	**DKK**	**4,0000/**	**87.688**	**28,0**	**4,7**	**0,00**		**Nej**	**0**
TotalKredit OF	**Obligation**	**1.035.000**	**1.035.000**	**964.414**	**DKK**	**5,0000/**	**58.995**	**28,8**	**5,9**	**0,00**		**Nej**	**0**
						/							
						/							
						/							

Source: totalkredit.dk

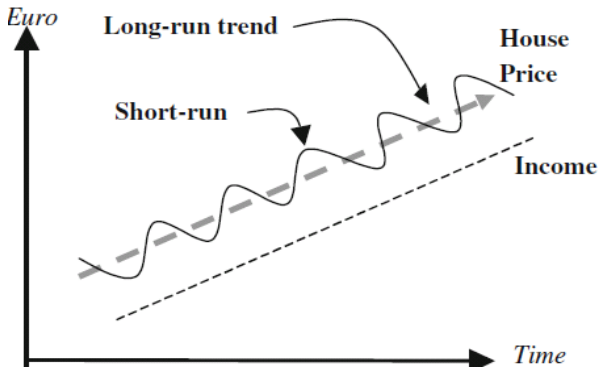
Appendix 9A: Measuring Housing Affordability by Nordea



Source: Nordea.dk- Privat/Bol

Appendix 10A: Elasticity of Real House Price Relative to Real Disposable Income- Empirical Evidence

Figure 14: the Long-run relationship between housing price and income and the short- run shocks on the housing market



Source: De Vries and Boellhouwer (2003)

Table 1 Elasticity of real house price relative to real disposable income

Country; Authors	Methodology	Elasticity of real house price relative to real disposable income	Outcome
Denmark: Danmarks Nationalbank (2003)	MONA	0,0554	The estimated coefficients show that an increase in real income by 1 per cent for a given stock of houses augments house price by 0,5 per cent in the long term
Denmark: Skaarup and Bødker (2010)	1971- 2009; VAR Model	0, 008 (income) 0,002 (financial wealth)	1 per cent increase in real disposable income causes real housing prices to expand by 0,8 per cent; while a similar increase in real financial wealth (excl. pension wealth) brings about a 0,2 per cent increase in housing price
Denmark: Wagner (2006)	ECM, 1984Q4-2005Q1	2.9	Increase in disposable income contribute by 59 % into house price formation
Ireland: Rae and van den Noord (2006)	Quarterly data from 1977 to 2004	1,5 for new houses 1,7 for second-hand houses	The income elasticities are high for long- run and for short- run housing prices, meaning that prices respond quickly to changes in households income
Muellbauer & Murphy (2008)			
Netherlands: de Greef and de Haas (2000)	1977 Q1- 1998 Q1	0,021	An increase of 1 per cent in real disposable income results in a 2,1 per cent increase in real housing prices
Netherlands: de Vries, Paul & Boelhouwer, Peter (2009)	ECM, 1978- 2005	0,64	The income- price relationship exist, , although market imperfections may render this ratio artificially high or artificially low during curtain periods

Netherlands: OECD Economic Survey (2004)	ECM (error- correction model), 1970- 2002	1, 94	High growth in real house prices is not attributable to strong demand but rather to weak supply responses by international comparison (especially compared with the US)
OECD countries: Miles & Pilonca (2008)	1996- 2006 for 14 OECD countries, simple calibrated model		The real income growth contributed about 35- 45 percentage point (pp) to real house price increases in most of the countries surveyed. In Norway 55 pp, Ireland (108pp- real income have justified more than a doubling of prices), however, modest real income contribution in the Netherlands (22pp) an Italy (9pp)
US: Case & Quigley (2008)		Mutual effect	When existing home sales (home price) decline or housing starts drop, the economy experiences a decline in aggregate expenditure and ultimately a reduction in income and employment
US and UK: Meen (2002)	ECM, 1981 Q3- 1998 Q2	2,7 disposable income (US) 0,70 wealth (US) 2,5 disposable income (UK) 0,4 wealth (UK)	It is however important to include housing supply in this relationship because failure to do so results in downward bias in the estimated income elasticity of house prices as income and the stock of dwellings are cointegrated
US: Gallin (2003)	Panel- data tests, applied to a panel of 95 US metropolitan areas over 23 years (1978-20019	He rejects the hypothesis based on p-values	House prices, income and population do not appear to be cointegrated on the national or local levels- no evidence for cointegration. This does not mean that fundamentals do not affect house prices, but it does mean that the level of house prices does not appear to be tied to the level of fundamentals

Source: own production

Appendix 11A: Housing Affordability

Figure 15: Gap in housing price growth and net disposable income growth, Denmark

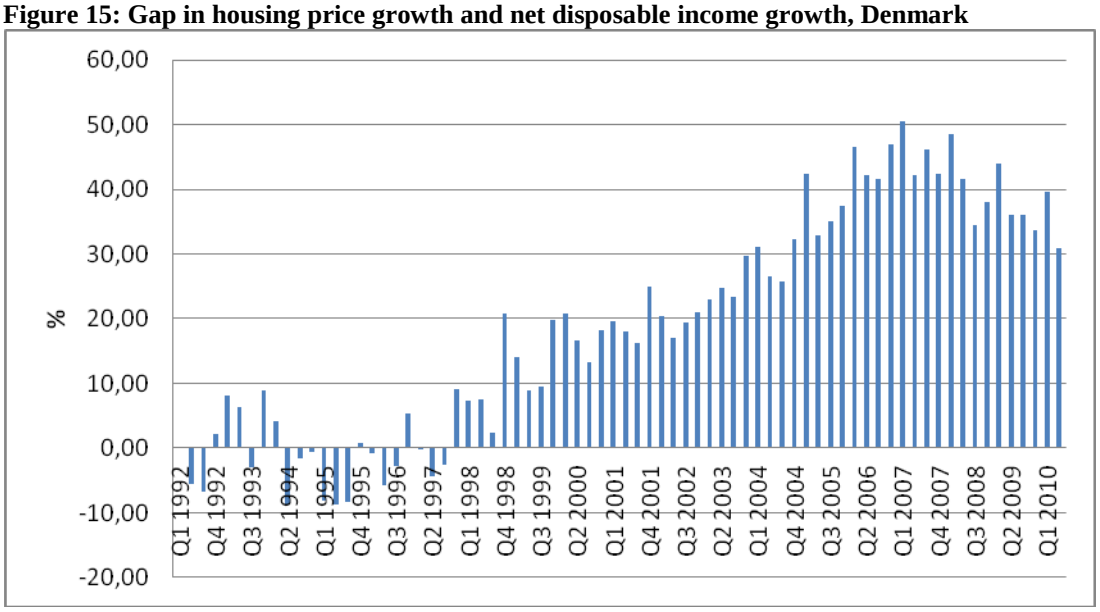
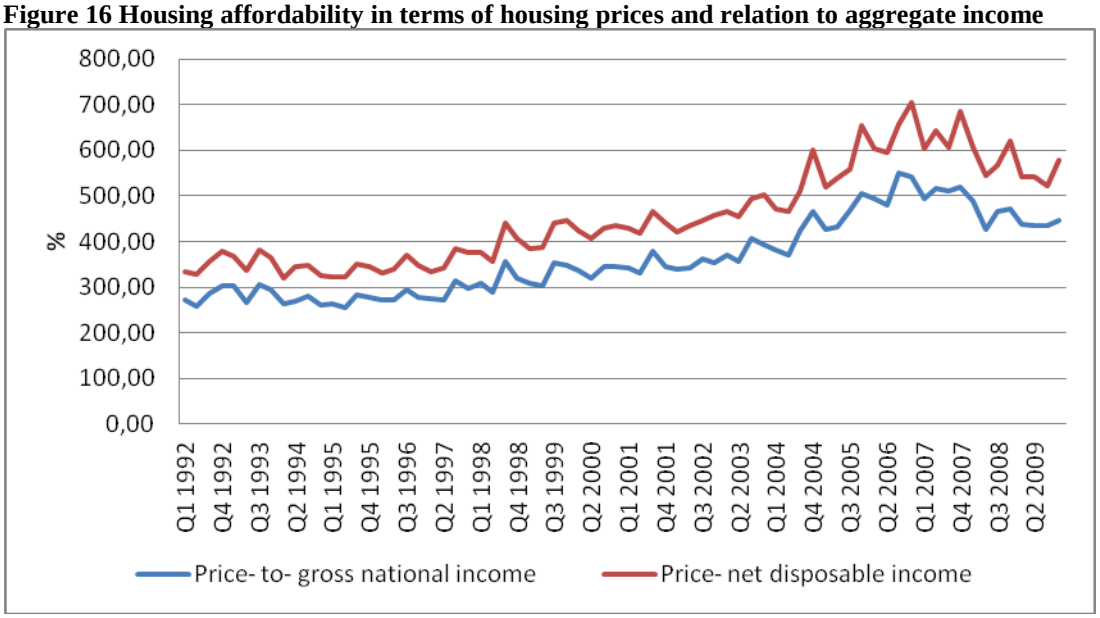


Figure 16 Housing affordability in terms of housing prices and relation to aggregate income



Source: Danmarks Statistics and own calculations

Appendix 12A: Housing Affordability across Household Types (for house and flat owner-occupiers)

Figure 17: Price-to-earned Income

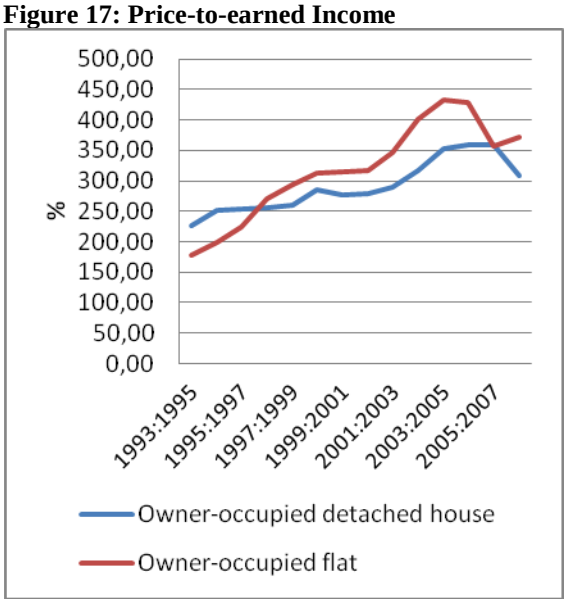
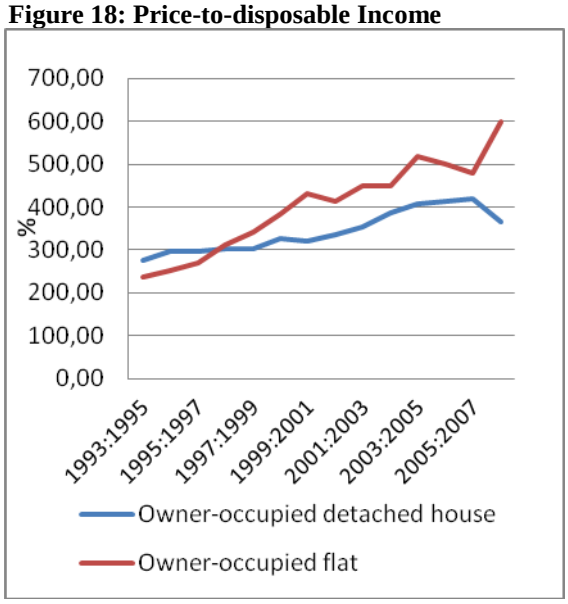
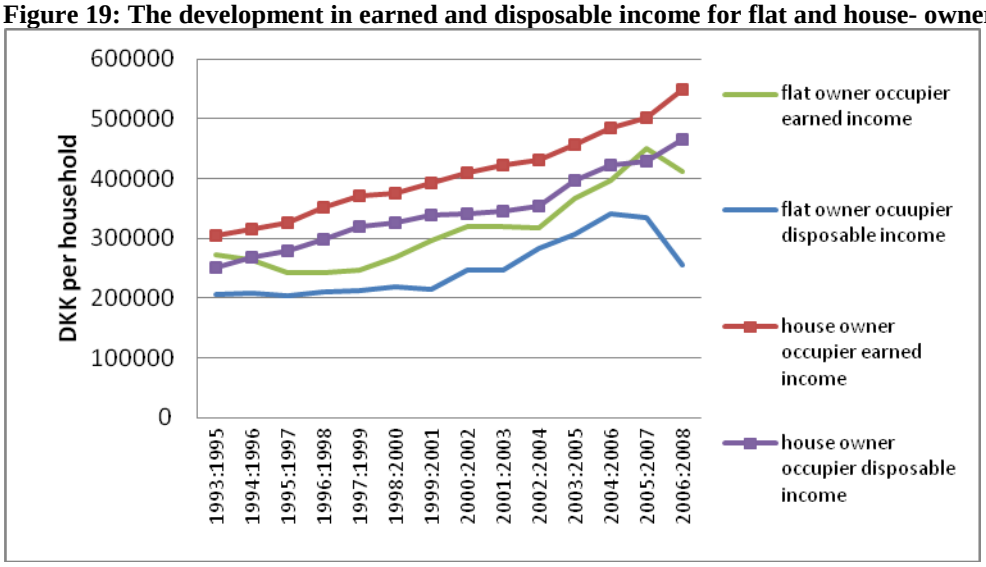


Figure 18: Price-to-disposable Income



Source: Danmarks Statistics and own calculations

Figure 19: The development in earned and disposable income for flat and house- owner occupiers



Source: Danmarks Statistics and own calculations

Appendix 13A: Housing Affordability across Household Type- an Extended Analysis

Table 2: The development in house and flat affordability variables

	House owner- occupiers housing affordability			flat owner- occupier housing affordability		
	growth in earned income	growth in disposable income	growth in house prices (3- year average growth)	growth in earned income	growth in disposable income	growth in flat prices (3- year average growth
1994:1996	3,41	6,71	14,35	-3,47	1,38	7,92
1995:1997	3,26	3,89	18,06	-7,72	-2,33	12,03
1996:1998	7,75	6,38	12,32	-0,73	2,86	21,97
1997:1999	5,24	6,97	16,23	2,50	1,38	28,31
1998:2000	1,07	2,16	17,26	7,91	3,09	25,03
1999:2001	4,67	4,11	11,96	9,61	-1,98	24,87
2000:2002	3,98	0,35	6,54	8,15	13,37	18,83
2001:2003	3,19	1,35	11,09	-0,32	-0,08	17,13
2002:2004	2,04	2,82	18,26	-0,71	13,76	22,51
2003:2005	6,08	10,91	27,94	14,75	8,05	36,20
2004:2006	5,82	6,38	24,26	7,71	10,83	29,34
2005:2007	3,19	1,90	10,81	12,85	-1,93	1,19
2006:2008	9,29	7,95	-2,62	-8,93	-26,76	-10,78
2007: 2009			1,22			2,46

Source: Statistics Denmark and own calculations

Figure 20: Changes in housing affordability variables for flat owner- occupiers

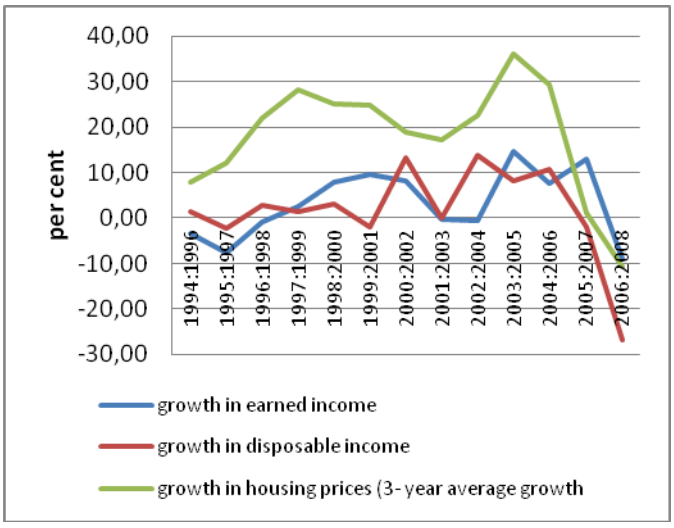
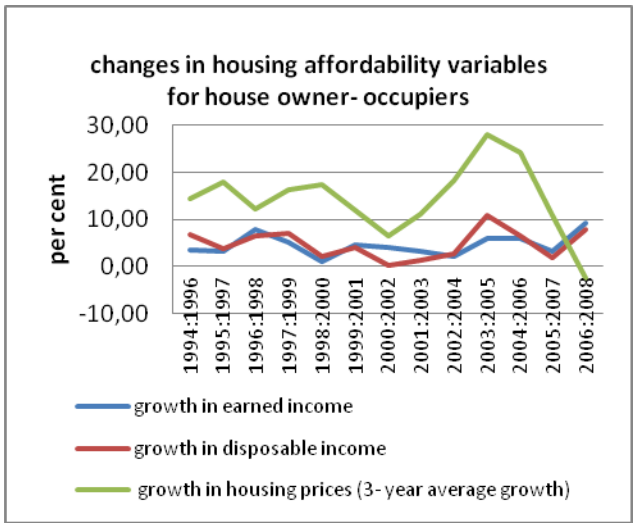


Figure 21: Changes in housing affordability variables for house owner-occupiers



Source: Statistics Denmark and own calculations

Appendix 13A (continued)

The figure shows that housing prices for flats constantly increased. Between 1995 and 1997, housing prices increased by 12, 03%, while there was decrease in earned and disposable income, by 3, 47 and 2, 33% correspondingly. First between 1996 and 1998, the disposable income positively increased while earned income decreased. Between 2000 and 2003, for flat owner occupiers,the growth in income disposable was higher than the growth in earned income which was higher by 5, 22 per cent. At higher income disposable, households were able to loan more. In this time the housing prices growth escalated even further. At the following years, between 2001 and 2003, there was negative trend in growth in disposable and earned incomes (decreased by 0, 32, and 0, 08%). In this period, the housing prices increased by 17, 13 per cent. First between 2002 and 2004, the increase in housing prices (by 22, 51 per cent) can be explained by higher growth in income disposable (by 13, 76 per cent) compare to the growth in earned income (a decrease by 0, 71 per cent). At the highest housing boom times (between 2003 and 2006), the housing price increased by 36, 20 per cent between 2003 and 2005 and by 29, 34 per cent between 2004 and 2006 can also be explained by the growth in disposable income

Thus, the improvement in income disposable point to improved housing affordability in median years 2001, 2003 and 2005. Therefore, it is a trigger for increased housing prices. The development partly supports the assumption that improved disposable income lead to increased housing demand, resulting in higher credit affordability. Thus, housing prices growth can be explained by increase in disposable income.

In median years (1996, 2002, 2004) housing price increase cannot be explained by higher growth in disposable income compare to earned income. According to Behavioral Finance Assumptions, the housing demand was driven by believes in constant increase in housing prices.

In bust times (2006- 2008), a decline in earned and disposable income (-8, 93 and- 26, 76 per cent correspondingly) reflected on declined housing affordability, as a result of income decline. Thus, the pressure on housing prices has already started in 2006, because of a decline in income disposable. It might also explain first decline on housing prices (by – 10, 78 per cent in corresponding period)

For house owner occupiers, between 1995 and 1997, the growth in earned income and disposable income was moderate, 3, 26 and 3, 89 per cent correspondingly and housing price increase by 18, 06 per cent. Thus, this increase cannot be explained by the growth in disposable income.

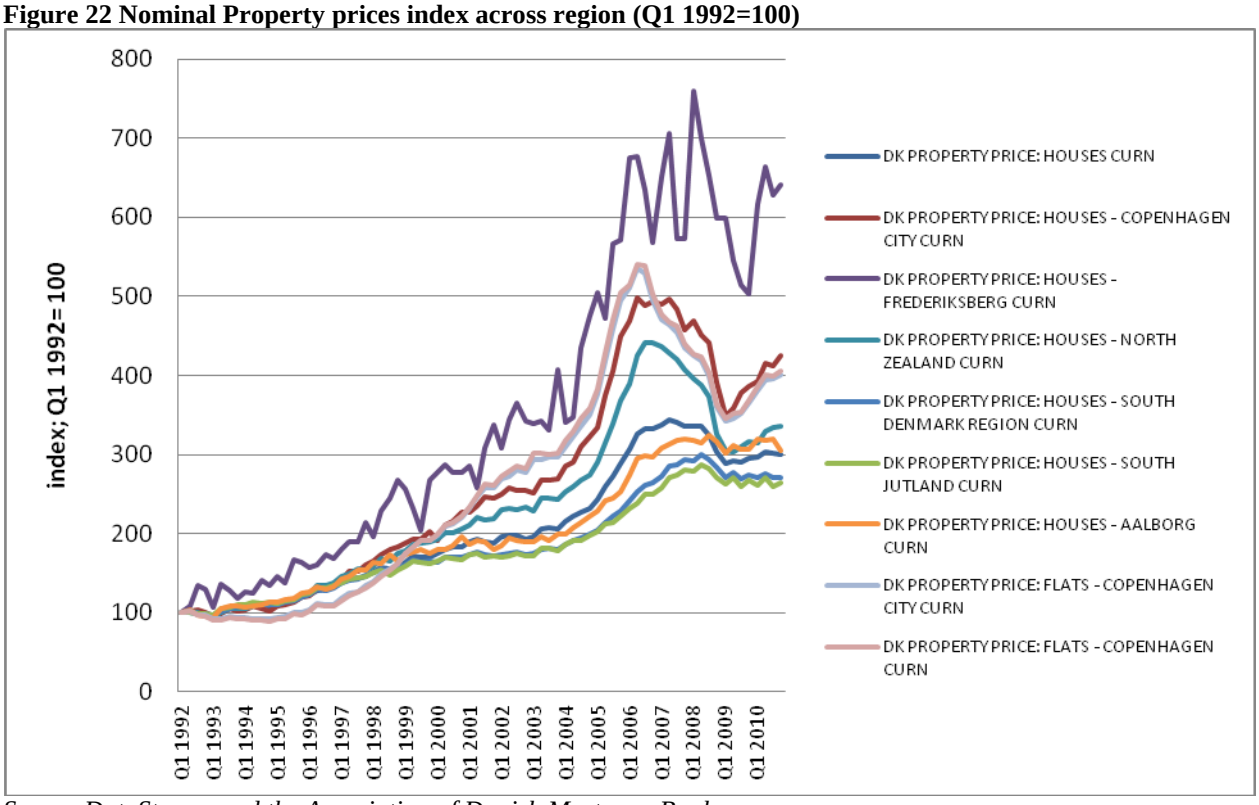
However, first in 2003: 2005 period, there was highest growth in disposable income through the whole period. While earned income increased by 6, 09 per cent, the disposable income increased by 10, 91 per cent, and the housing prices increased by 27, 94 per cent, the highest housing price increase.

In bust period (2006: 2008), the prices decreased by – 2, 62 per cent in spite of increased in earned and disposable income by 9, 29 and 7, 95 per cent correspondingly.

To conclude, in housing boom times (2000- 2006) the growth in housing prices can in few years be explained by the growth in disposable income rather than earned income. The growth in disposable and earned income, on the other side, was not as strong as the growth in housing prices. However, the yearly growth in housing prices, prior to 2006 generally cannot be explained by improved disposable income.

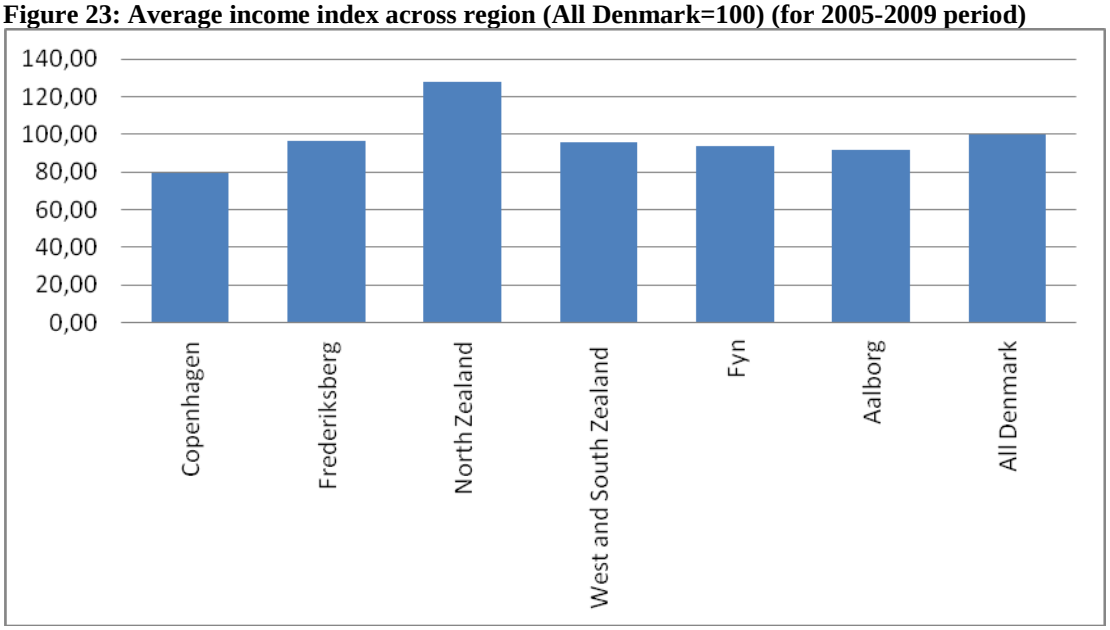
Appendix 14A: Housing Affordability across Cities

Figure 22 Nominal Property prices index across region (Q1 1992=100)



Source DataStream and the Association of Danish Mortgage Banks

Figure 23: Average income index across region (All Denmark=100) (for 2005-2009 period)



Source: Danmarks Statistics and own calculations

Appendix 15A: Affordability by Including Housing-Related costs

- Calculate your true living expenses in your new home. Remember to take into account the *maintenance charge* in addition to the loan payments.
- Find out if there are *renovations* planned for the future and the estimate their costs rather too high than too small.
- Consider if you would like to pay off a possible housing company loan with a housing loan. If you do this, you get the full benefit of the interest deduction as a first-time home buyer and can agree on changes concerning the loan based on your situation.
- Prepare for different changes such as rising interests rate or unexpected events with different hedging products. They will give leeway in surprising changes in life. (www.nordea.fi)

Box 1: Advice on Housing affordability by Nordea, Source: www. Nordea.fi

Figure 22: Yearly average expenditure on total repair and maintenance during 1993- 2009 across dwelling type, Denmark, DKK per household

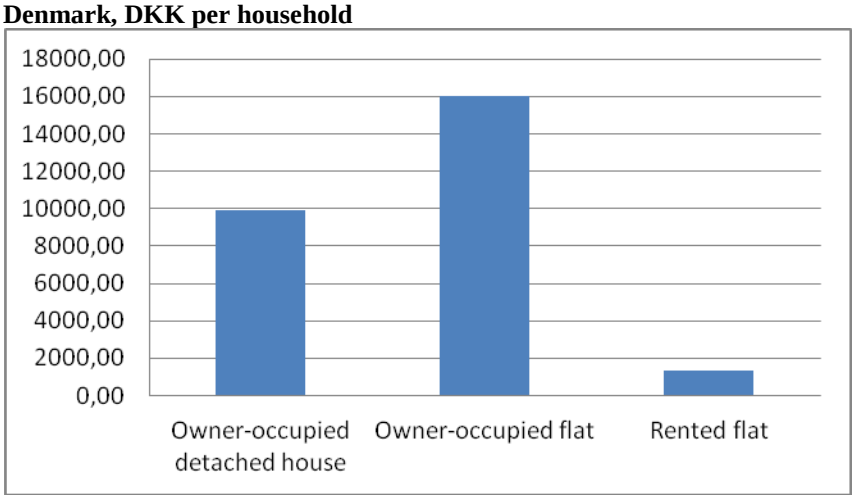
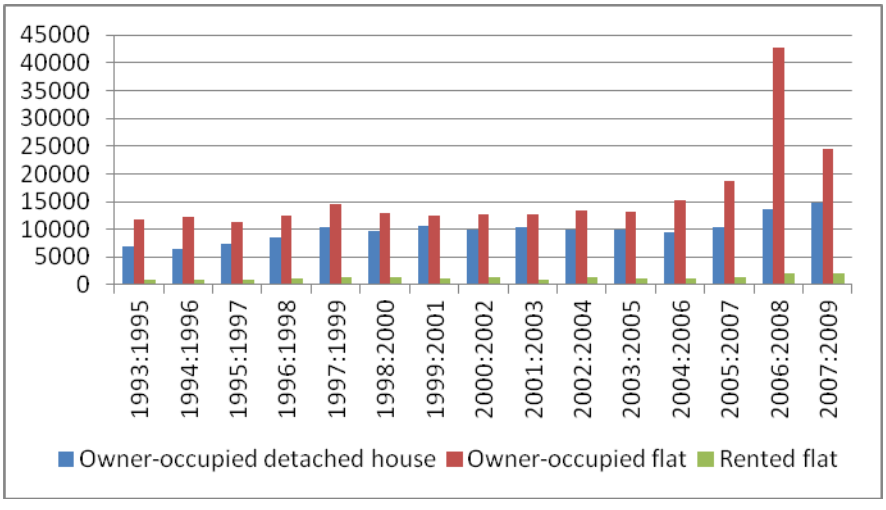


Figure 23: Yearly expenditure on total repair and maintenance during 1993- 2009 across dwelling type, DKK per household



Source: Denmarks Statistics

Table 3: Total housing-related costs development and as a percentage of total consumption, housing prices and income disposable

	Total repair and maintenance; DKK per household			% of total consumption			% of housing prices		% of income disposable	
	Owner-occupied detached house	Owner-occupied flat	Rented flat	Owner-occupied detached house	Owner-occupied flat	Rented flat	Owner-occupied detached house	Owner-occupied flat	Owner-occupied detached house	Owner-occupied flat
1993:1995	7022,9	11757,1	988,8	3,09	6,36	0,70	1,02	2,42	2,80	5,71
1994:1996	6482,3	12244	935,2	2,76	6,78	0,64	0,82	2,33	2,42	5,86
1995:1997	7310,2	11327,1	1003,7	3,00	6,59	0,66	0,89	2,07	2,62	5,55
1996:1998	8462,7	12524,6	1061,5	3,25	6,73	0,66	0,94	1,92	2,85	5,97
1997:1999	10279,1	14499,6	1396	3,80	7,32	0,83	1,06	2,00	3,23	6,81
1998:2000	9637,2	12930,2	1407,6	3,46	6,10	0,83	0,90	1,54	2,96	5,89
1999:2001	10566,2	12467	1265,3	3,77	5,83	0,75	0,97	1,34	3,12	5,79
2000:2002	10036	12753	1397,1	3,54	5,78	0,82	0,88	1,26	2,95	5,18
2001:2003	10308,6	12807,9	978,5	3,54	5,70	0,56	0,85	1,16	2,99	5,21
2002:2004	9960,4	13392,4	1318,1	3,32	5,80	0,73	0,73	1,05	2,81	4,75
2003:2005	9908,9	13124,2	1201	3,16	5,46	0,65	0,61	0,83	2,50	4,29
2004:2006	9573,2	15196,3	1245,8	2,80	5,70	0,63	0,55	0,89	2,27	4,46
2005:2007	10431,8	18649,1	1356,6	2,83	6,25	0,64	0,58	1,16	2,43	5,58
2006:2008	13579,6	42607,5	2135,3	3,55	11,74	1,00	0,80	2,79	2,92	16,66
2007:2009	14798,7	24423,5	2155,8	3,72	7,44	1,00	0,81	1,48	non-avail	non-avail
average	9890,52	16046,90	1323,09	3,31	6,64	0,74	0,83	1,62	2,78	6,27

Source: Danmarks Statistics-"Investigation of consumption" and own calculations

Figure 24: Repair and maintenance cost as % of total consumption

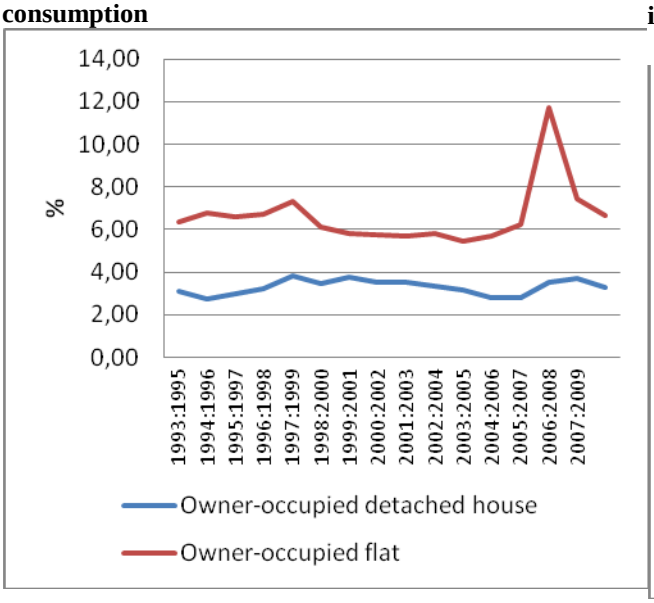
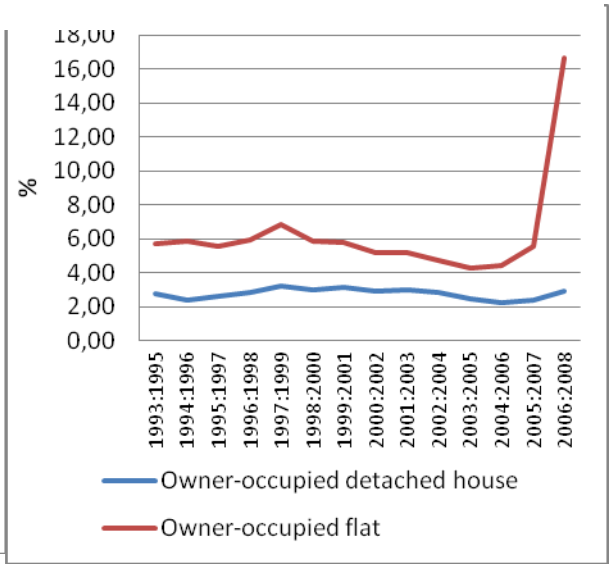
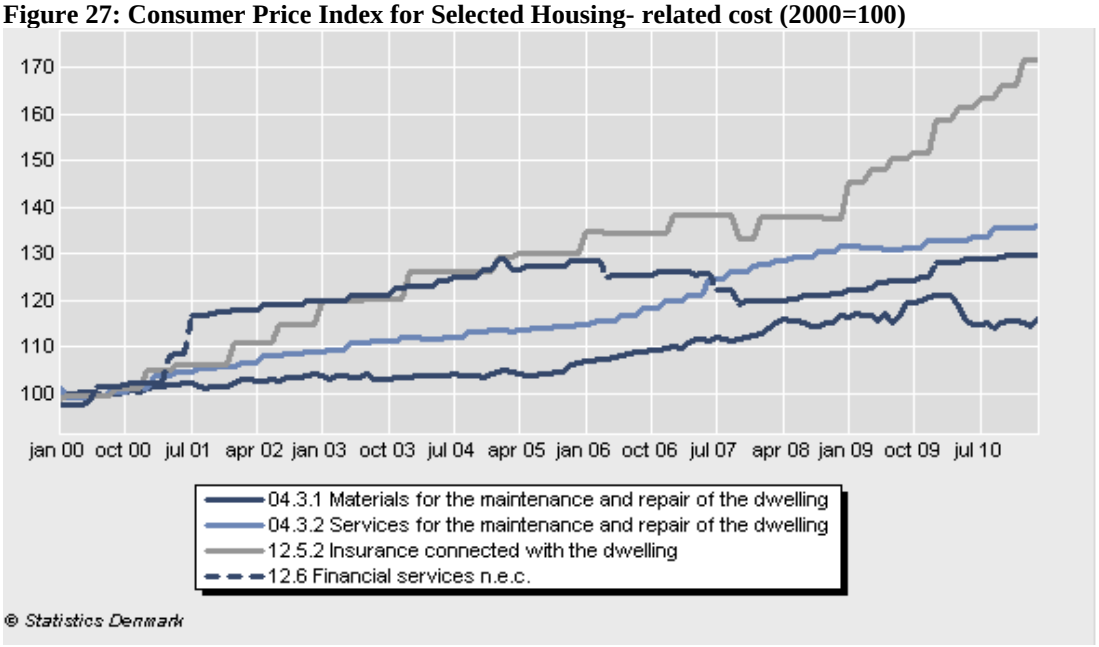


Figure 25: Repair and maintenance cost as % of income disposable



Source: Danmarks Statistics-"Investigation of consumption" and own calculations

Figure 27: Consumer Price Index for Selected Housing- related cost (2000=100)

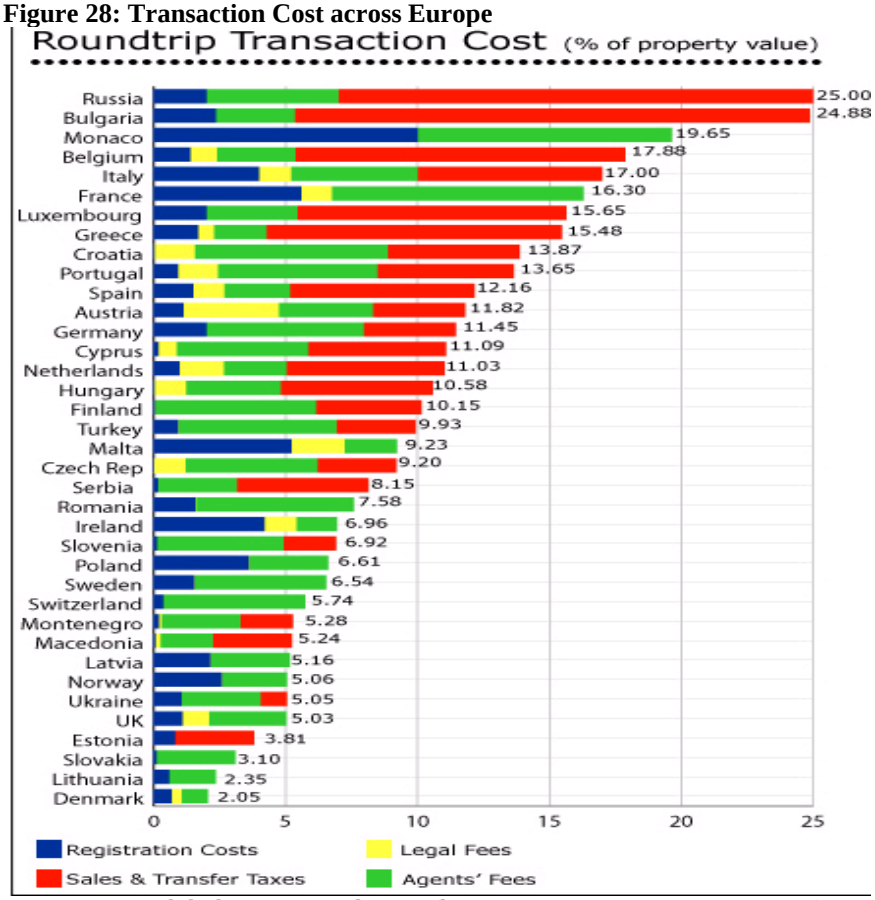


Source: http://www.statbank.dk/statbank5a/default.asp?w=1280 (consumer price index)

The index shows the monthly changes in the costs of buying a fixed basket of goods, the composition of which is made up in accordance with the households' consumption of goods and services.

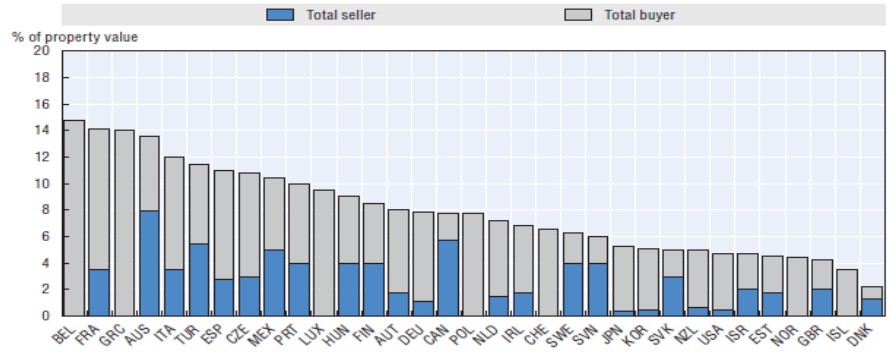
Appendix 16A: Transaction Cost in Europe

Figure 28: Transaction Cost across Europe



Source: www.globalpropertyguide.com (housing transaction cost in Europe)

Figure 29: Transaction Cost across OECD countries for buyers and sellers



1. Transaction costs refer to average costs. The estimates do not take into account the various tax breaks that exist in countries for certain dwellings implying that the estimated cost may overestimate the actual cost in some countries (for example in Italy) where such tax breaks are frequent. In addition, VAT when applied to certain costs is not included due to data limitations.

Source: Johansson, Å. (2011), "Housing Policies in OECD Countries: Survey-based Data and Implications", *OECD Economics Department Working Papers*, forthcoming.

StatLink http://dx.doi.org/10.1787/888932368726

Appendix 12A: Property Transaction Cost in Denmark

Table 2 Property Transaction cost in Denmark- an overview

Item cost and who pays	Amount, DKK	Source/ Law	Notes (Direct translation /explanations)
One- time taxes to the Danish Government (Land Register) / by the buyer (afgift til statskassen)	1400 for property registration transfer and 0.6 per cent of the property value (paragraph.4) or 1400 for mortgage registration and1.5 per cent of the mortgage amount (paragraph. 5)	"lov om afgift af tinglysning og registrering af ejer- og panterettigheder" tinglysningsafgiftsloven (www.retsinformation.dk)	Consolidated Act on taxes on land registration and registration of ownership and liens
Expenditures to the mortgage institution / buyer	Ca. DKK 2.000 for mortgage establishment	Bekendtgørelse af lov om finansiel virksomhed	
Real estate agents' fee/ seller	Is generally negotiable, ranging from 0.5% to 2% of housing price, depending upon the value of the property and the amount of work	Dansk Ejendomsmæglerforenings forbrugeretiske regler	
Administrative costs/ buyer (skøde)	DKK 2.000- 4.000	Bekendtgørelse af lov om tinglysning	A deed is the official document showing that the property has changed ownership. It can contain all the details from contract, but may in principle only contain information on price, acquisition date and a few other things.
Ownership insurance (ejeskifterforsikring)/buyer, however, can be shared if the seller has presented you with a status report and a quote for an ownership insurance from an insurance company and offered to pay half the premium for this ownership insurance, surpassing virtually all responsibilities for housing state to you as the buyer	Between DKK 7.000 and 15. 000 incl.tax	Bekendtgørelse om dækningsomfanget for ejerskifteforsikringer i henhold til lov om forbrugerbeskyttelse ved erhvervelse af fast ejendom m.v.	Ownership insurance designed to cover damage not shown in the status report because they have not been observed by housing inspection or that the building qualified by an error has not indicated in the report.
Lawyer or other legal representative /both, optional	DKK 3.000- 10.000	De advokatetiske Regler	Legal concultancy including: Home insurance constructional counseling (byggeteknisk rådgivning) Status report (tilstandsrapporten) Change of ownership Refunding (fortrydelsesret) Soil contamination (Jordforurening)

Status rapport (tilstandsrapporten)/ by the seller, however, can be shared with the buyer	DKK 4.000- 10.000	Bekendtgørelse af lov om forbrugerbeskyttelse ved erhvervelse af fast ejendom m.v.	
The prove of a buyer financial situation (Boligkøberbevis)	Counseling for free		With a house purchase prove (boligkøberbevis-buyer certificate) the buyer is pre-approved to borrow a certain amount. the certificate is obtained from the local bank, savings bank or cooperative after reviewing borrower's finances.
Cancelation cost	1% of the selling price	Bekendtgørelse af lov om forbrugerbeskyttelse ved erhvervelse af fast ejendom m.v.	A buyer can withdraw from the purchase agreement within 6 days, however must pay 1 per cent of the selling price to the seller
Property value tax (Ejendomsværdigskat)	Ca. 1 percent of the property value below DKK 3,040,000 (3 per cent above)	Bekendtgørelse af ejendomsværdiskatteloven Also www.skat.dk	
Land tax (property tax) to the municipality	Ca. 1 percent of the property value (may not raise by more that 7 per cent)	Bekendtgørelse af lov om kommunal ejendomsskat	Property tax (land tax) to the municipality calculated the land value (less any deductions for improvements).
The cost of rat control and waste from property	Not significant	Bekendtgørelse af lov om kommunal ejendomsskat	

Source: www.boligejer.dk/budbekendtgoerelsen; www.skat.dk; www.retsinformation.dk; www.totalkredit.dk and own production

Note: Some of the expenditures are estimated and can vary depending on the size of a propert

Appendix 18A: Housing Affordability across Demographics

Methodology in calculation: The price-to-income ratio across demographics is calculated based on the average total sales housing prices divided by average income disposable per household. The ratio is presented in percentage. It represents housing price in proportion to income disposable.

Source to figures 30- 35 is the extract from the "Investigation of Consumption", Danmarks Statistics

Figure 30: Housing affordability development across age of a main income earner

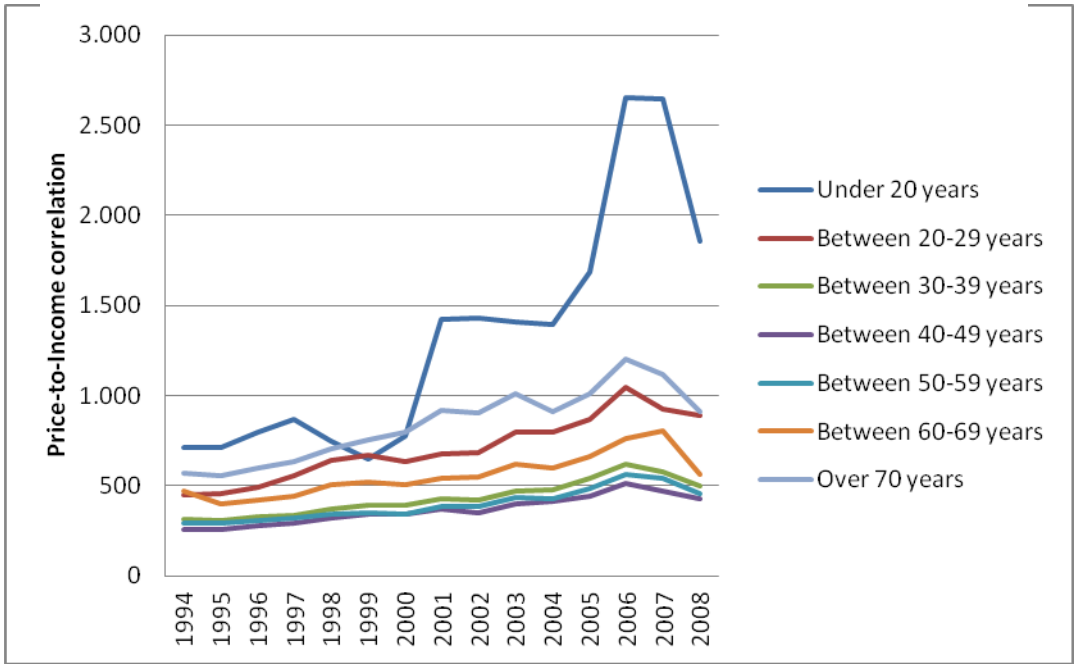
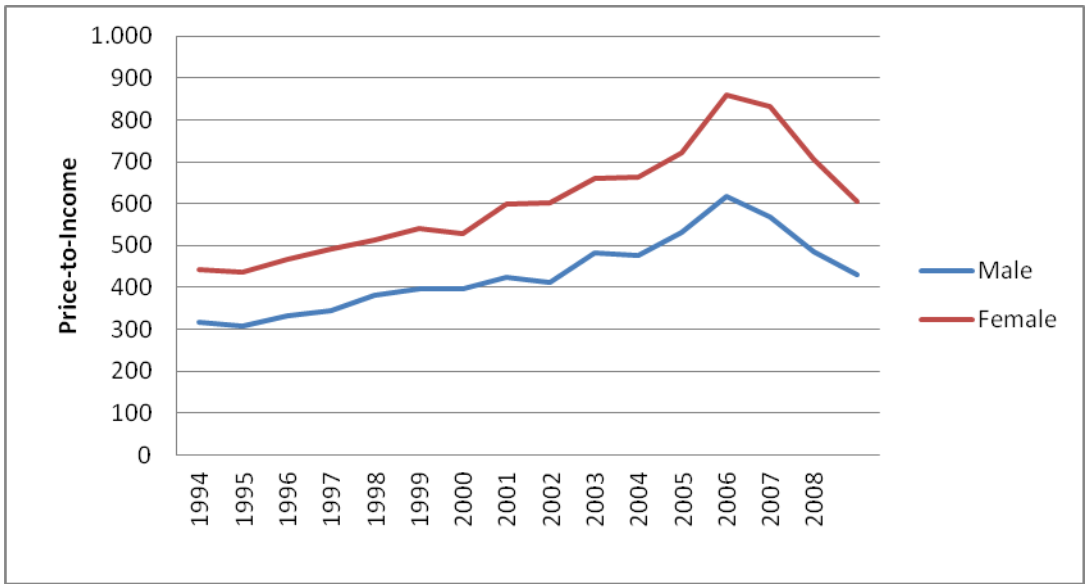


Figure 31: Housing affordability development across sex of a main income earner



Source: Danmarks Statistics-"Investigation of Consumption" and own calculations

Figure 32: Housing affordability development across dwelling types

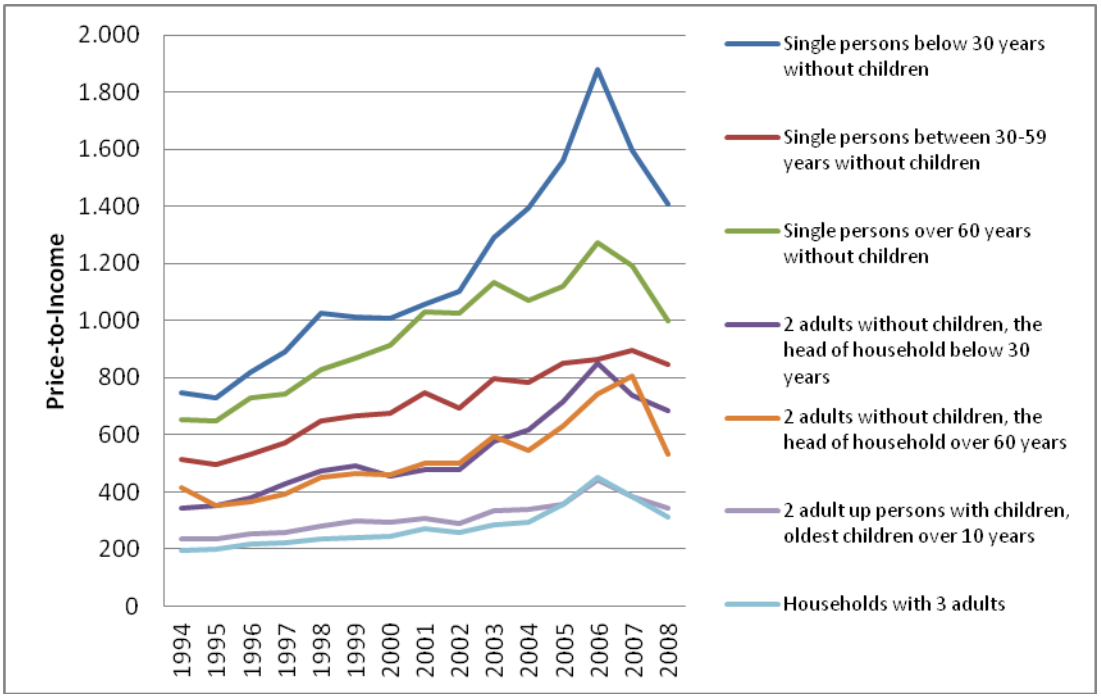
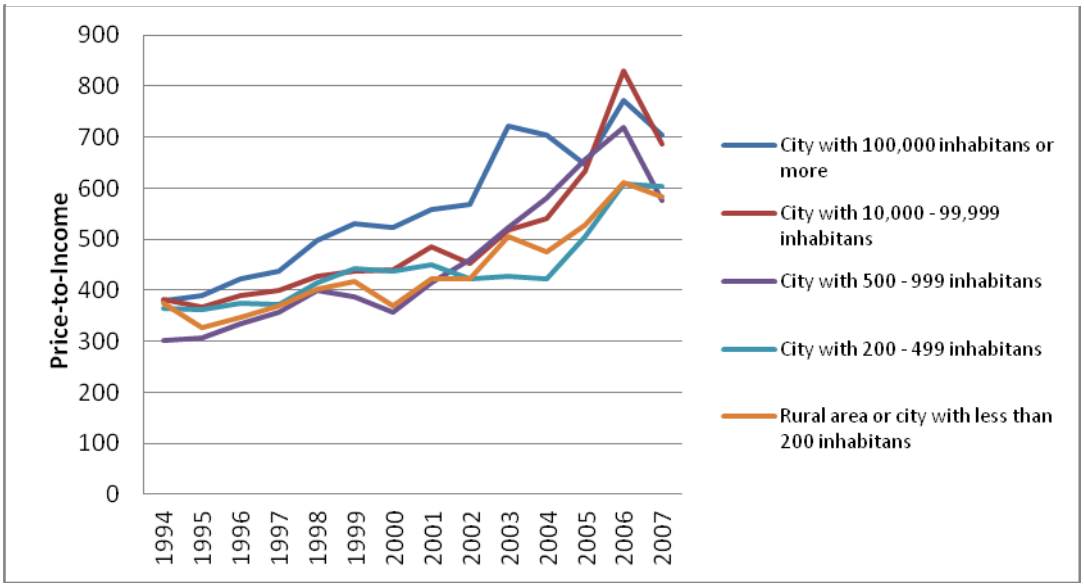


Figure 33: Housing affordability development across urban/rural areas



Source: Danmarks Statistics-"Investigation of Consumption" and own calculations

Figure 34: Housing affordability development across socioeconomic status of the main income earner

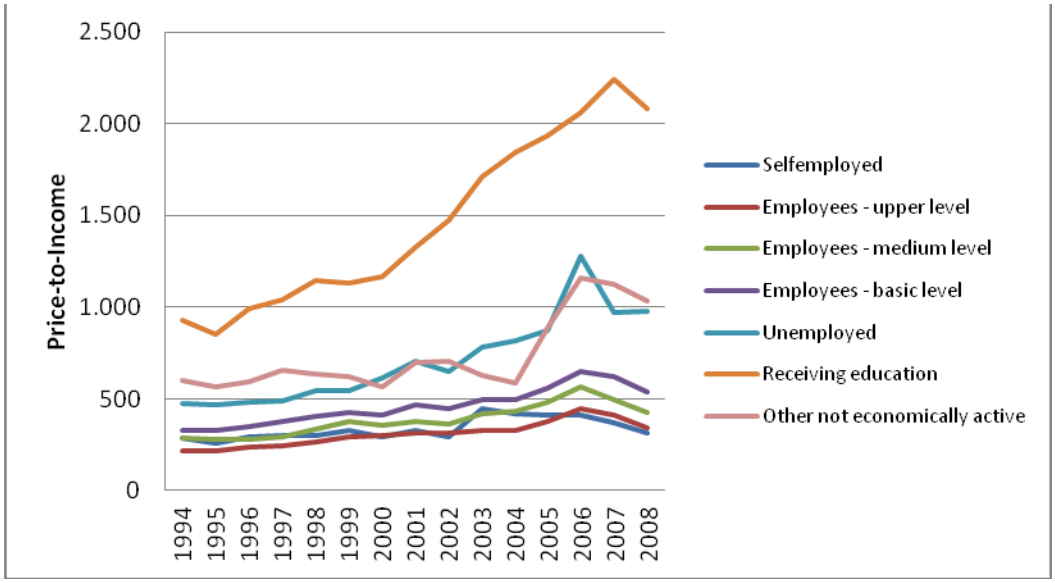
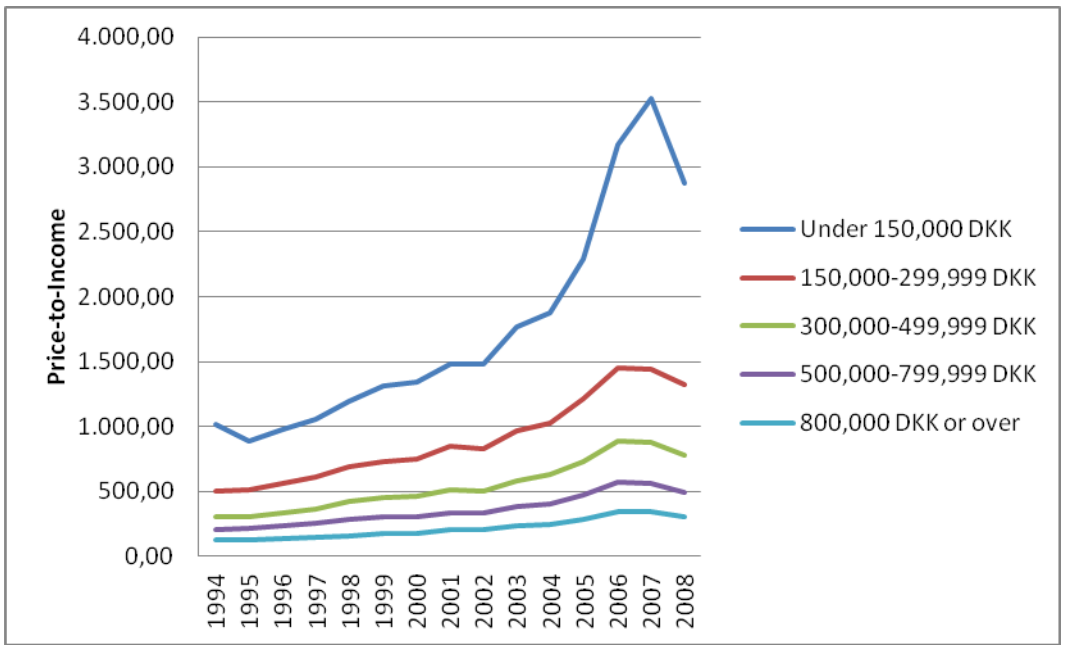


Figure 35: Housing affordability development across different income groups



Source: Danmarks Statistics-"Investigation of Consumption" and own calculations

Notes to appendix 18A

An analysis of housing affordability on the aggregate level might lead to misleading results.
For example, if the housing affordability improved on the aggregate level (due to lower housing prices), it is expected that more buyers will enter the market.
However, if the improvement is not significant amongst 30- 39 year old, a proxy for first- time buyers, the demand for housing, therefore, might be unchanged.
In addition, the development in housing affordability across demographics is interesting to predict the housing affordability crisis. For example, the weakest socio-economic status groups (a household, with a main income earner under 20 years and over 70 years, as well as between 20-29 years from figure 32; single persons from figure 32 and households that earn under DKK 150.000 per year, as well as between DKK 150.000- 299.999) experienced the most significant decline in the housing affordability development. At the same time, amongst upper level of socio-economic status groups, the housing affordability did not change so much, or even improved (seen from figures 34, 35). Thus, during the 1994- 2008 period, the development in housing affordability amongst different demographic groups, had indicated, that especially the weakest socio- economics demographic groups find housing purchasing less affordable. It in turn, eliminated them from the housing market, especially after 2000.

Thus, the figures reveal that housing became unaffordable for the weakest socio- economic groups, while housing affordability amongst the upper socio- economic groups did not change so much. This development exacerbates the housing affordability crisis as more households are locked out of the housing market. Those results could not be seen from the analysis on the aggregate level.

Appendix 19A: Empirical Findings on Elasticity of Real House Price Relative to Real Interest Rate

Table 3: Elasticity of real house price relative to real interest rate

Source: own production

Country; Authors	Methodology	Elasticity of real house price relative to real interest rate	Outcome
Denmark: Danmarks Nationalbank (2003)	MONA model	-0,7927	A fall in long- term interest rates after tax by 1 per cent in the long term increases house prices by almost 8 per cent
Denmark: Skaarup and Bødker (2010)	1971- 2009, VAR Model	-0,12	A 1 per cent increase in the before- tax real interest rate leads to a 12 per cent reduction in real housing prices
Denmark: Wagner (2005)	ECM, 1984Q4-2005Q1	-7,7	9/10 of house prices increase since 1993 can be explained by fundamentals
Ireland: Rae and van den Noord (2006)	Quarterly data from 1977 to 2004	-2.0 for new houses and for second-hand houses	The reduction in short- term interest rate has boosted demand for housing in Ireland
Miles & Pilonca (2008)	1996- 2006 for 14 OECD countries, simple calibrated model		Lower real interest rate justified price increase ranging from 30 to 70 %
Netherlands: de Greef and de Haas (2000)	1977 Q1- 1998 Q1	-0,011	A rise of 1 per cent of the real effective mortgage interest rate induces a decrease of the real housing prices of 11 per cent
Netherlands: OECD Economic Survey (2004)	ECM, 1970- 2002	-7,1	High growth in real house prices is not attributable to strong demand but rather to weak supply responses by international comparison (especially compared with the US)
Netherlands: de Vries & Boelhouwer (2009)	ECM, 1978- 2005	-1,5	A long- run relationship between net interest payments and income rather income and price became key variables in affordability
Taylor (2009a, 2009b)	Taylor rule: monetary-policy rule that stipulates how much the central bank would or should change the nominal interest rate in response to divergences of actual inflation rates from *target* inflation rates and of actual Gross Domestic Product (GDP) from *potential* GDP	Clearly evidence that there were monetary excesses during the period leading up to the housing boom.	The actual interest rate decisions fell well below what historical experience would suggest policy should be. It thus provides an empirical measure that monetary policy was too easy during this period, or too "loose fitting rule was not followed in part of the 2000s, possibly leading to the housing bubble Also, the housing boom were largest where the deviations from the rule were largest
US, UK: Meen (2002)	ECM, 1981Q3- 1998 Q2 for US 1969-1996 for UK	-1,3 for US -3,5 for UK	

Appendix 20A: Credit Variables in Denmark- Development in Figures

Figure 36: Changes and total lending and GDP, Denmark

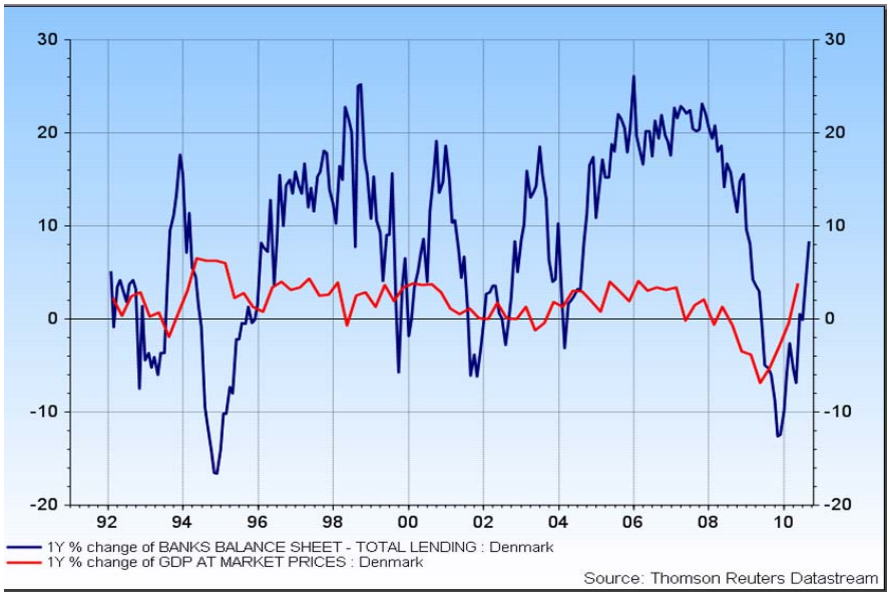


Figure 37: Yearly percentage change in total lending and prices of owner-occupier flats

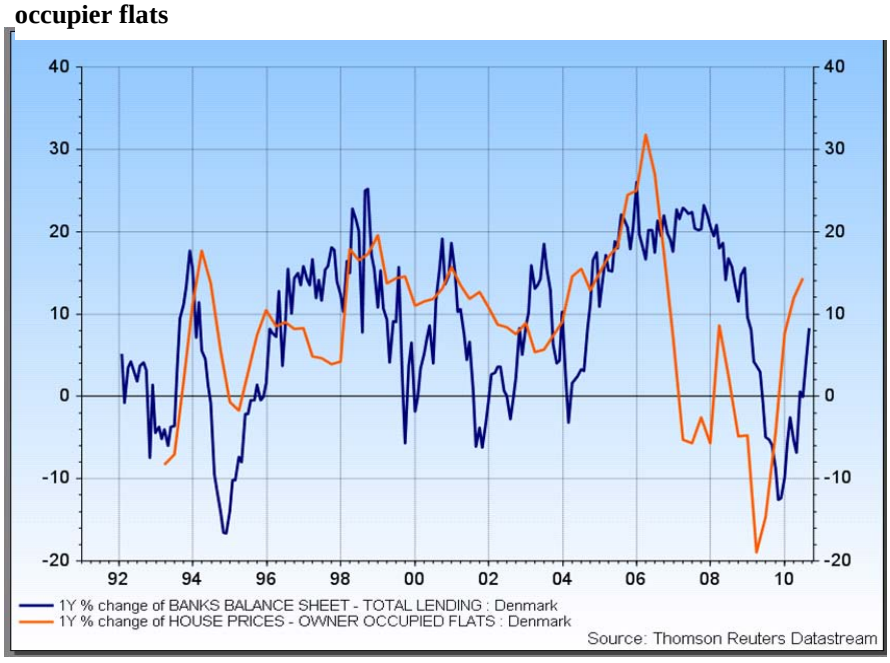
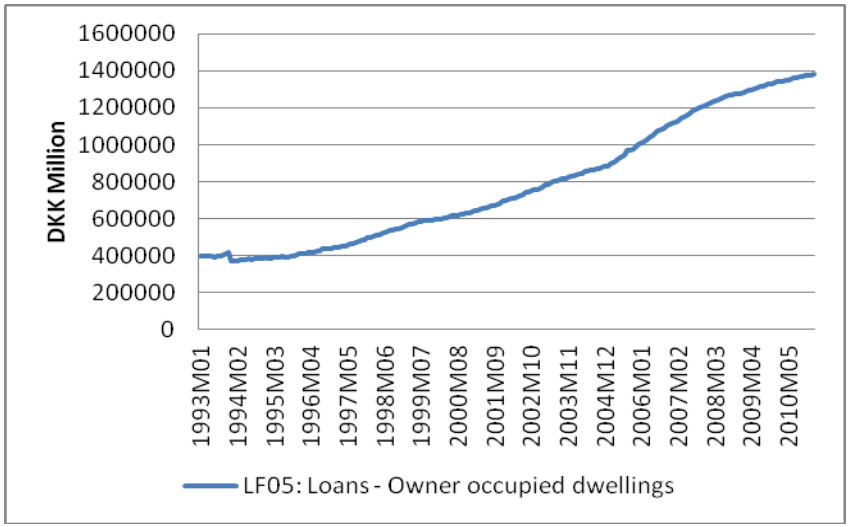
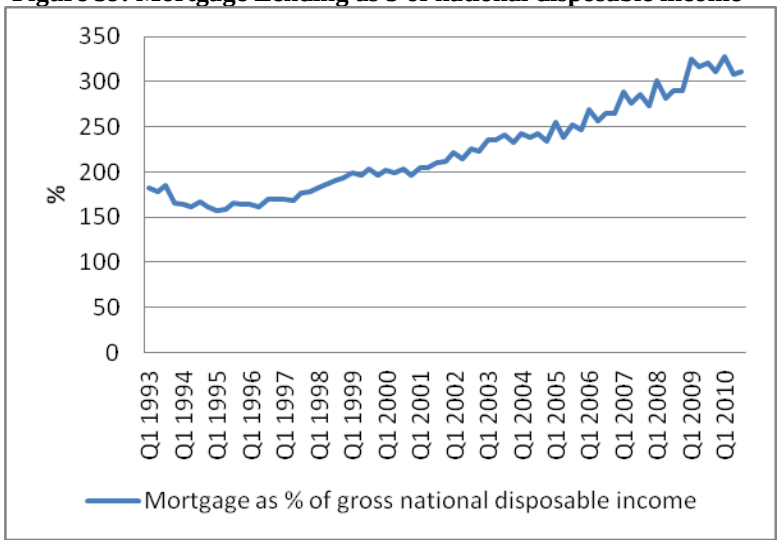


Figure 38: Owner- Occupiers mortgage loans, Denmark



Source: Danmarks Statistics (all tables) and own calculations

Figure 39: Mortgage Lending as 5 of national disposable income



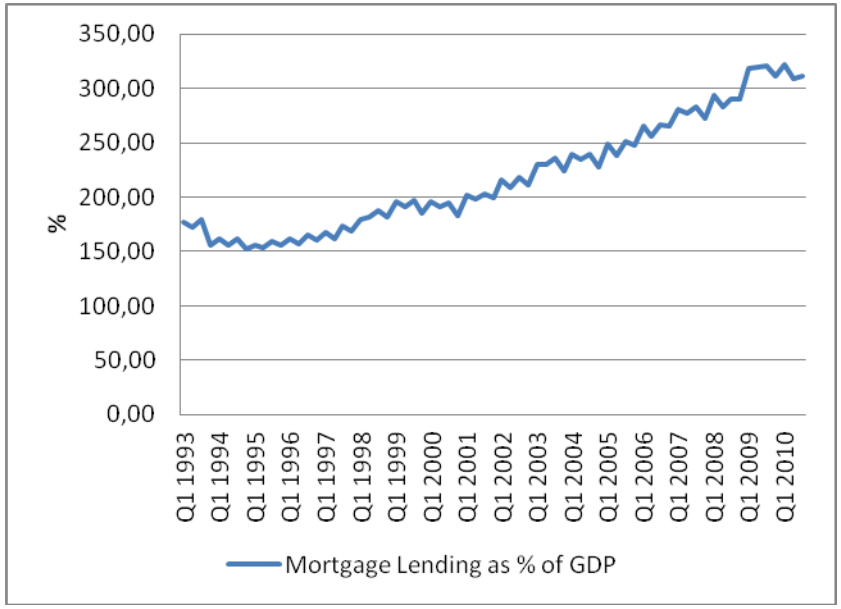


Figure 40 : Mortgage Lending as % of GDP

Figure 41: 30- year mortgage credit bond yield

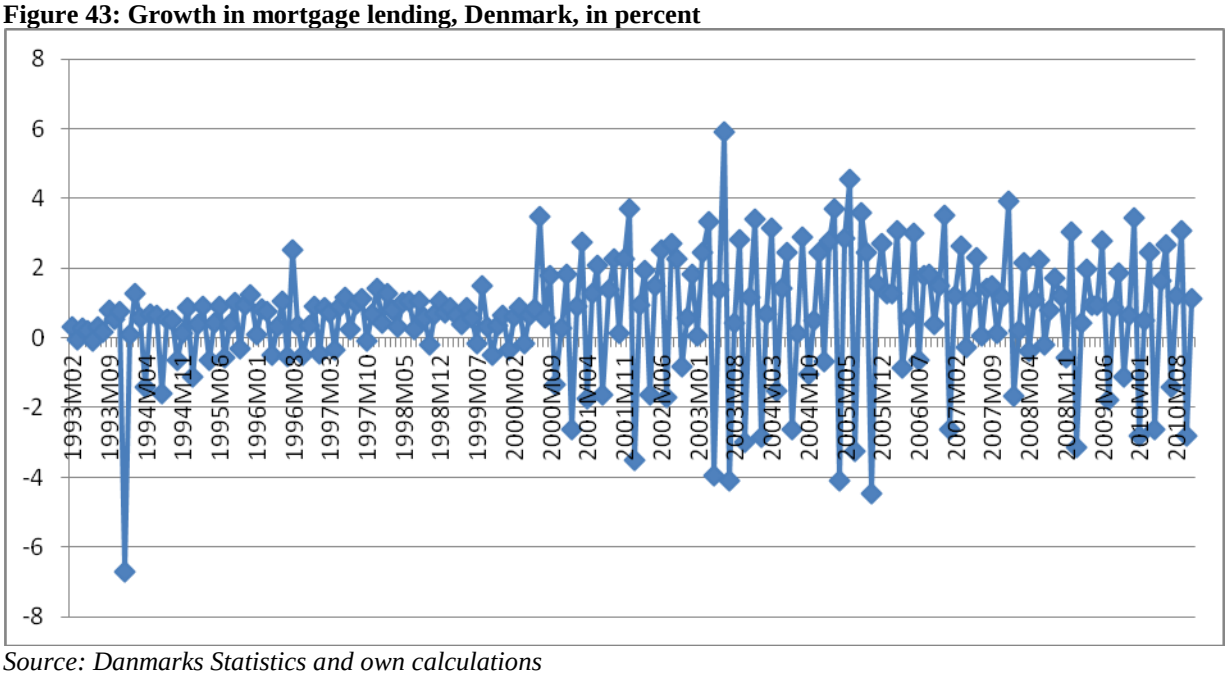
Figure 42: Households mortgage debt and interest burden, selected countries

Table III.1. **Households mortgage debt and interest burden**

	Mortgage debt			Interest payments			Variable interest rates
	% of household disposable income						% of all loans
	1992	2000	2003	1992	2000	2003	2002
United States	58.7	65.0	77.8	4.9	5.2	4.5	33[1]
Japan	41.6	54.8	58.4	2.5	1.3	1.4	..
Germany	59.3	84.4	83.0	3.9	4.0	3.0	72[2]
France	28.5	35.0	39.5	1.7	1.4	1.1	20
Italy	8.4	15.1	19.8	0.7	0.8	0.7	56
Canada	61.9	68.0	77.1	5.9	5.7	4.9	25[1]
United Kingdom	79.4	83.1	104.6	4.4 [1]	3.7	3.0	72
Australia	52.8	83.2	119.5	4.8	6.4	7.9	73[1]
Denmark	118.6	171.2	188.4	10.6	9.9	8.3	15[2]
Finland	56.7	65.3	71.0	7.1	2.9	1.9	97

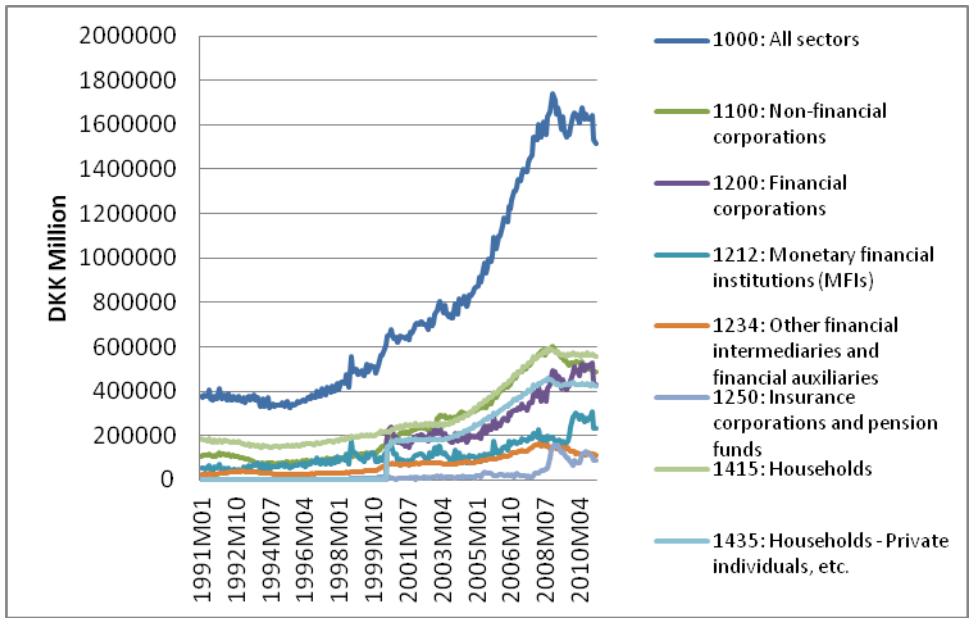
Source: Girouard et al. (2006a)

Figure 43: Growth in mortgage lending, Denmark, in percent



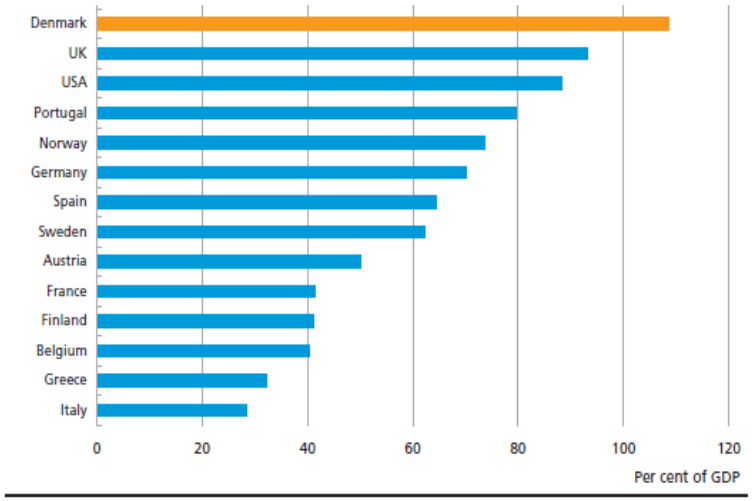
Source: Danmarks Statistics and own calculations

Figure 44: Total banks lending by type, Denmark



Source: Danmarks Statistics

Figure 45: Household debt as a ratio of GDP, 2004



Note: Debt in the household sector is calculated on the basis of the financial sector accounts in the national accounts.
Source: Eurostat and OECD.

Appendix 21A: Specific Balance Principle vs. General Balance Principle in the Danish Mortgage Credit System

The general balance principle

The general balance principle

In reality, the Danish mortgage credit system is without liquidity and refinancing risk. This is due to the balance principle, the backbone of the Danish mortgage credit system.

An important factor for investor security in Danish mortgage bonds is the balance principle. The principle safeguards a very close connection between the payments from the borrowers to the mortgage banks and the mortgage banks' payments to the bond owners.

The balance principle is a central concept in the Danish mortgage credit model. The balance principle means that there is a close match between the bonds and the mortgage loans issued. For example, a mortgage bank issues and sells 30-year bonds with a fixed interest of 5 pc at a value of DKK 1m in order to issue and pay out a 30-year mortgage credit loan with a fixed interest of 5 pc to the amount of DKK 1m. This is called match-funding.

This means that there at all time is complete transparency in the Danish mortgage system. The mortgage banks have used an effective balance principle in combination with close coupling between listed mortgage bonds and the loans granted. This is the foundation of the market-based prepayment system, which offers borrowers flexible possibilities for prepaying their loans - whenever they want and without any negotiation with the issuer. This is unparalleled in Europe.

In addition, the balance principle means that the mortgage credit system has a very low degree of financial risk, which contributes positively to financial stability

The specific balance principle

The specific balance principle is virtually identical to the existing balance principle, whereas the general balance principle in some aspects represents a modernization of the specific balance principle. One of the changes consists of a wider scope for the liquidity risk, which is of importance to the financial stability.

Immediately after the SDO (covered bond) legislation had been passed, the mortgage banks were required to make a decision about their choice of balance principle. Two mortgage banks chose the general principle and four the specific balance principle. However, that is not the most interesting thing – the most interesting thing is the fact that in practice the mortgage banks have – with no exception – chosen to continue with the match funding between mortgage credit lending and bond issuance

Where loans are funded by the issuance of SDOs and SDROs, valuations are based on the open market value of a property. Where loans are funded by ROs, valuations are based on the

mortgageable value. In Denmark, the mortgageable value will correspond to the open market value in the vast majority of cases, cf sections 10-15 of the Mortgage Act.

LTV limits - an overview

Loan type --- Property category	Covered bond - SDO	Covered mortgage bond - SDO	Mortgage Bond - RO
Residential property	80% or 70% (1)	80% or 70% (1)	80%
Holiday property	60%	60%	60%
Agricultural property	60% (2)	60% (2)	70%
Commercial property	60% (2)	60% (2)	60%

Note:

1) 80% for loans issued with up to 30 years maturity and 10 years interest-only period and 70% for loans with an unlimited maturity and interest-only period. From July 2009 the limit rises to 75%.

2) The LTV can be raised to 70% if the bank adds additional collateral.

Source: www.realkreditraadet.dk- Danish Mortgage Model

Appendix 22A: Credit Policies Survey

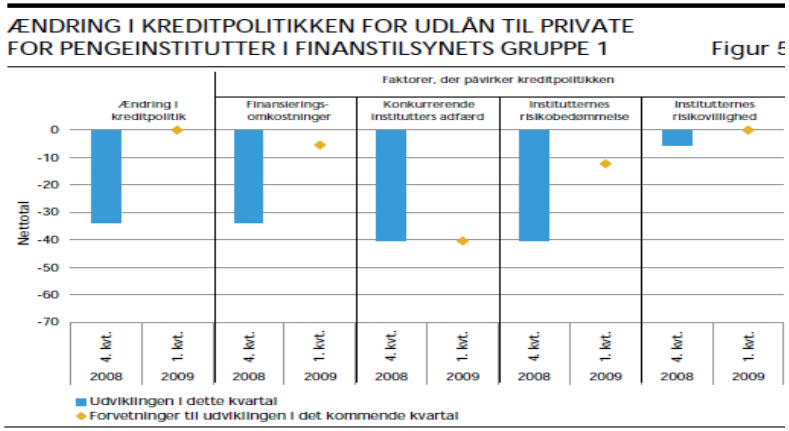
The poll was conducted as a survey where credit manager in each department assesses changes in loan demand and supply and the terms on loans over the past quarter and anticipated changes in the coming quarter. The results contribute to an increased understanding of the Danish credit market in particular by illustrating changes in institutions' credit policies and loan conditions. The study should be viewed as a complement to existing quantitative statistics for the MFI sector loans and interest.

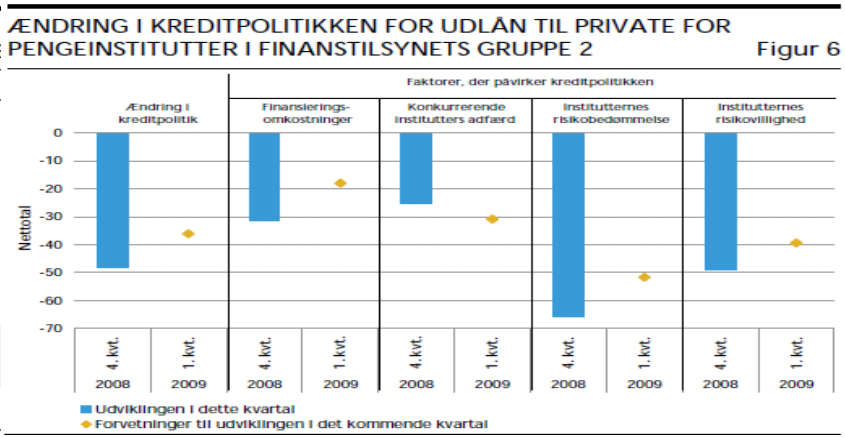
The study includes the largest banks say. FSA Group 1 and 2 and the five largest mortgage companies (ie Nykredit Mortgage, Mortgage Denmark, Nordea Kredit BRFkredit and DLR Kredit).

Methodology

The study is qualitative and performed by credit managers of the Participating institutions answering questionnaires concerning changes in their lending and lending policies. Institutions answering 10 questions each has five possible answers, which institutions can add explanatory comments. Departments' answers are summarized in net by giving answers one of the following values: -100 (tightened / decreased a lot), -50 (tightened / decreased slightly), 0 (unchanged), +50 (relaxation / increased slightly) +100 (relaxed / increased somewhat). Department response weighted by their share of total lending. The net figure is thus between -100 and +100. A negative (positive) figure corresponds to institutions overall have tightened (eased) credit policy in the period, so that it has become harder (easier) to obtain loans.

When the net figure of expectations for the coming quarter is 0, it means that institutions not expect further changes in the coming quarter, while a negative (positive) figure indicates an expected tightening (easing) in the next quarter

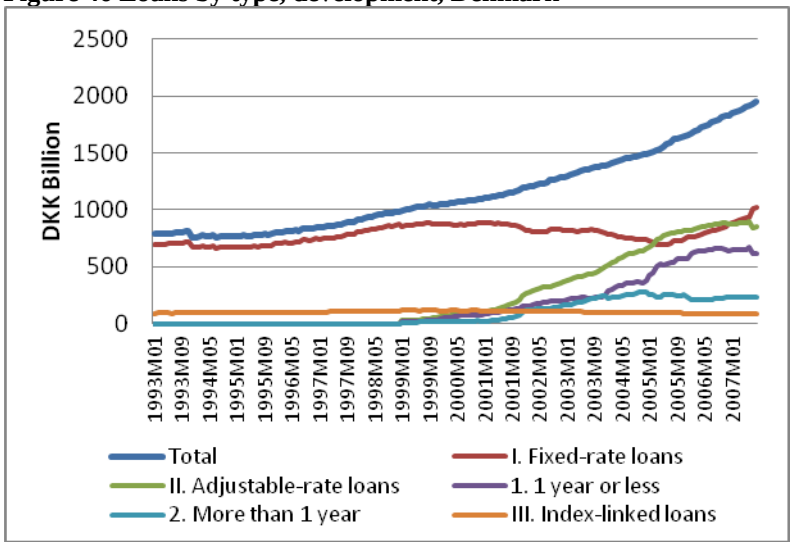




Source: Danmarks Nationalbank

Appendix 23A: Mortgage Market Products and Development

Figure 46 Loans by type, development, Denmark



Source: Danmarks Statistics (figure) and the Association of Mortgage Banks (boxes)

Box 2: Adjustable-rate mortgages

Adjustable-rate mortgages (ARMs) were introduced in 1996 and soon became popular. The main advantage of ARMs is that interest rates are generally lower than those of fixed-rate loans when raised.
However, the borrower does not know the future repayments as the interest rate will change throughout the loan term following interest rate resets. The interest rate is generally reset at a frequency of 1, 3, 5 or 10 years. The interest rate is reset when the underlying bonds are replaced by new bonds. The yield of the new bonds determines the loan rate for the period until the next interest rate reset. The lower initial loan rate should therefore be weighted against the risk that it will increase during the loan term.
An ARM may be prepaid at a price of 100 in connection with each interest rate reset. Alternatively, the borrower may prepay the loan by purchasing the bonds on market terms – as with all mortgage loans

Box 1: Fixed-rate loans
The long-term – typically 30-year – fixed-rate, callable loan is considered the most traditional mortgage loan. With this loan, the borrower knows in advance the fixed repayments payable throughout the term of the loan. The long-term fixed-rate mortgage loan has a prepayment option, which may be exercised in two ways:

1. Borrowers may prepay their debts outstanding at a price of 100 (par).
2. Borrowers may purchase the underlying bonds in the financial markets and deliver them to the mortgage bank.

This is the cheapest method if the price of the bonds is below 100. In practice, mortgage banks purchase the bonds on behalf of borrowers.
Today, all long-term fixed-rate loans may be prepaid at a price of 100. This provides borrowers with a high degree of security. Without this option, the market price of the bonds could rise to much more than 100 if yields tumble. And that would make it expensive to buy the underlying bonds – they would be much more expensive than the borrower's debt in nominal terms.
The option of prepaying at a price of 100 also gives borrowers a higher protection against becoming technically insolvent if interest rates decline, leading to a rise in bond prices. A borrower is technically insolvent if the total mortgage debt exceeds the value of the property. Being technically insolvent is not a problem until a borrower needs to sell the property, because the sales proceeds will not cover the mortgage debt

Box 3: Floating-rate loans - with or without interest rate cap

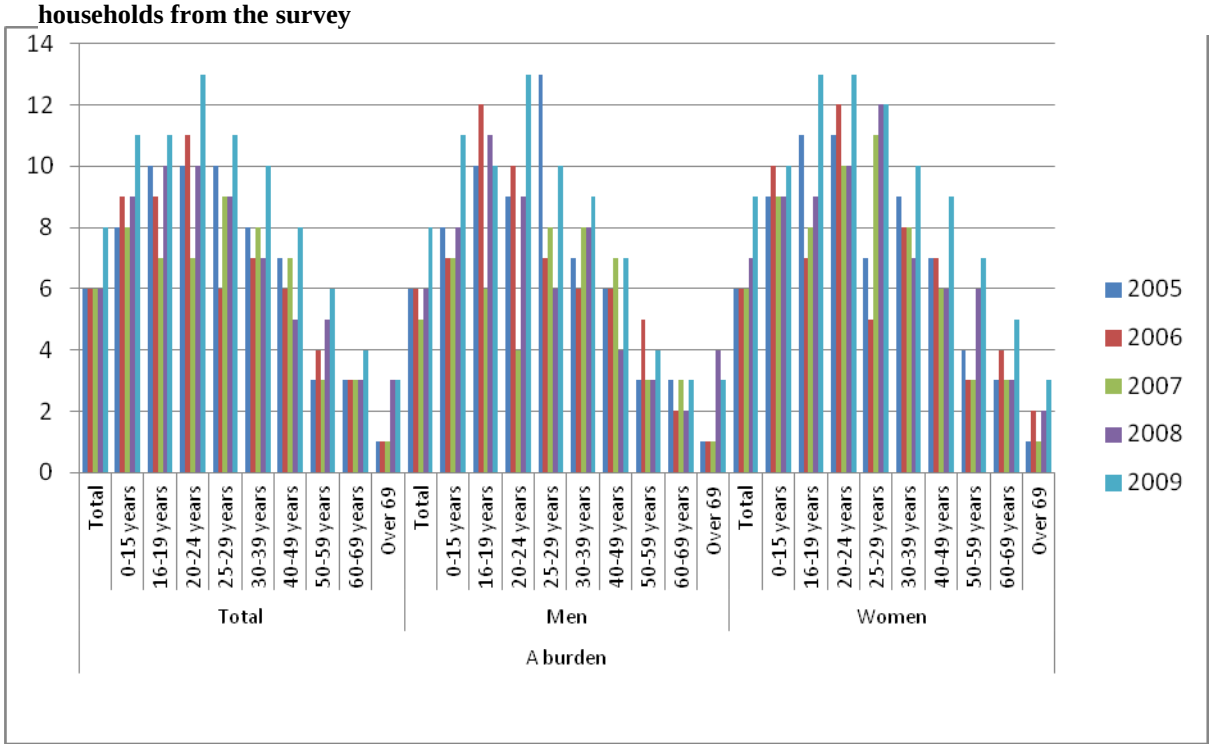
Floating-rate loans derive from ARMs. The principal difference is that the loan rate changes at a shorter frequency, generally three or six months. In addition, the loan type differs from ARMs in that this interest rate depends on a reference rate, ie an interest rate determined in another market. The reference rate of DKK-denominated loans is Cibor (Copenhagen Interbank Offered Rate), an interest rate which is quoted daily by the Danish central bank, Danmarks Nationalbank. It is possible to get a loan with a floating interest rate which cannot exceed a certain level (cap). This way, the borrower hedges against major interest rate increases. If a loan has a cap of 6%, the interest rate can never be higher than 6%. The loan rate will track Cibor, as long as it does not exceed 6%.
A floating-rate loan may be prepaid in three ways: either at an agreed price – typically 100 or 105 – or like an ARM at 100 when the underlying bonds are replaced. Finally, the borrower may buy the underlying bonds at market price.

Appendix 24A: Financial Burden of the total housing cost of households across age, time and sex

The figure bellow shows the ability to manage debt service burden through 2005- 2009 periods among Danish households (from The Statistics of Denmark, investigation “Indicators of Welfare”)
Tables show percentage of different households that have a burden problem, that have some burden problem and that have no burden problem. The values are in percent of the total of the group. The data refers to spring/ summer each year.
I apply the analysis to derive:

- the level of households with a burden problem
- the most vulnerable households type
- the most financially strong households type

Figure 47 Distribution of a financial burden of the total housing cost across age and sex, in % of all households from the survey



Source: Danmarks Statistics, Indicators of wealfare

Figure 48 Distribution of a few financial burden of the total housing cost across age and sex, in % of all households from the survey

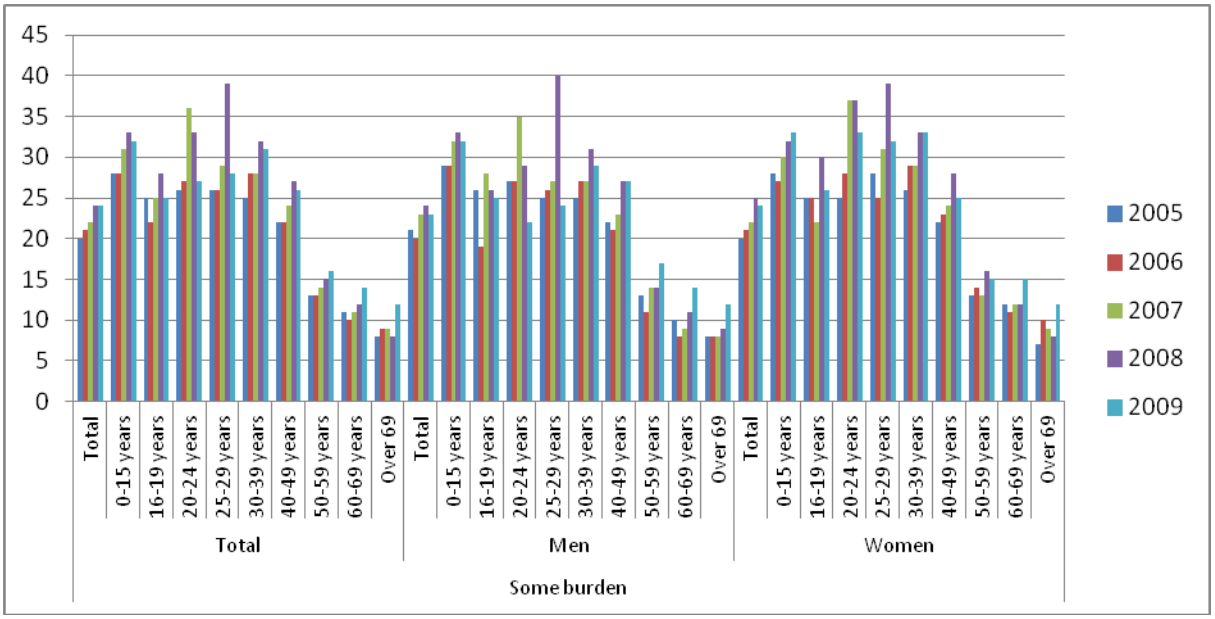
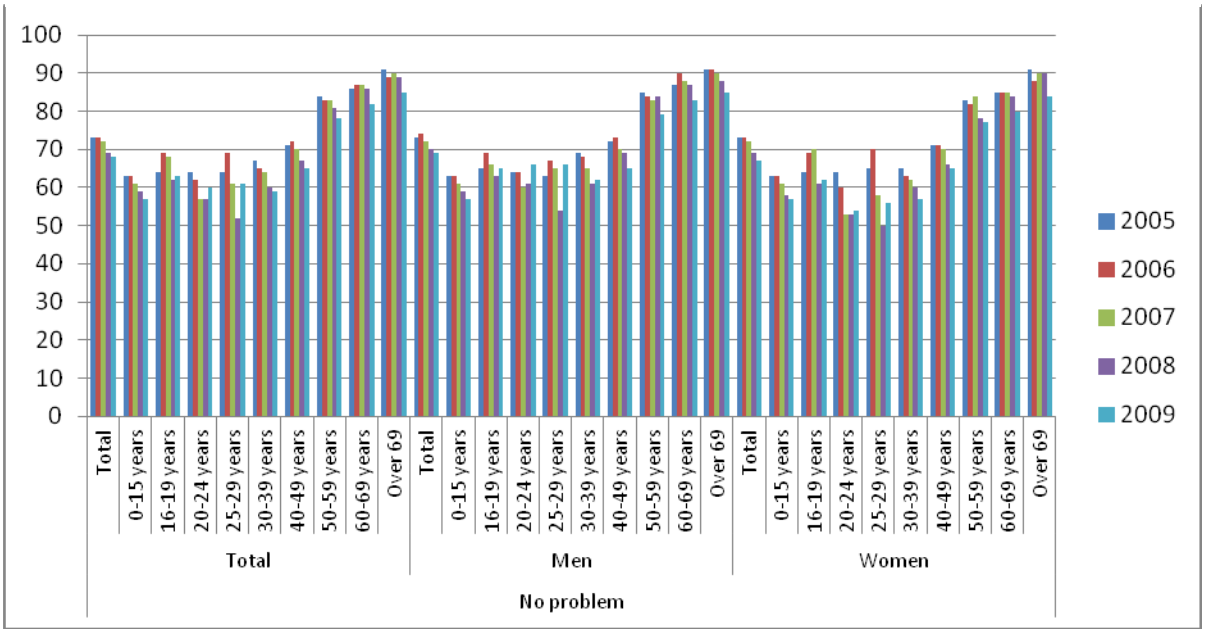


Figure 49 Distribution of no financial burden of the total housing cost across age and sex, in % of all households from the survey



Source: Danmarks Statistics, Indicators of wealfare

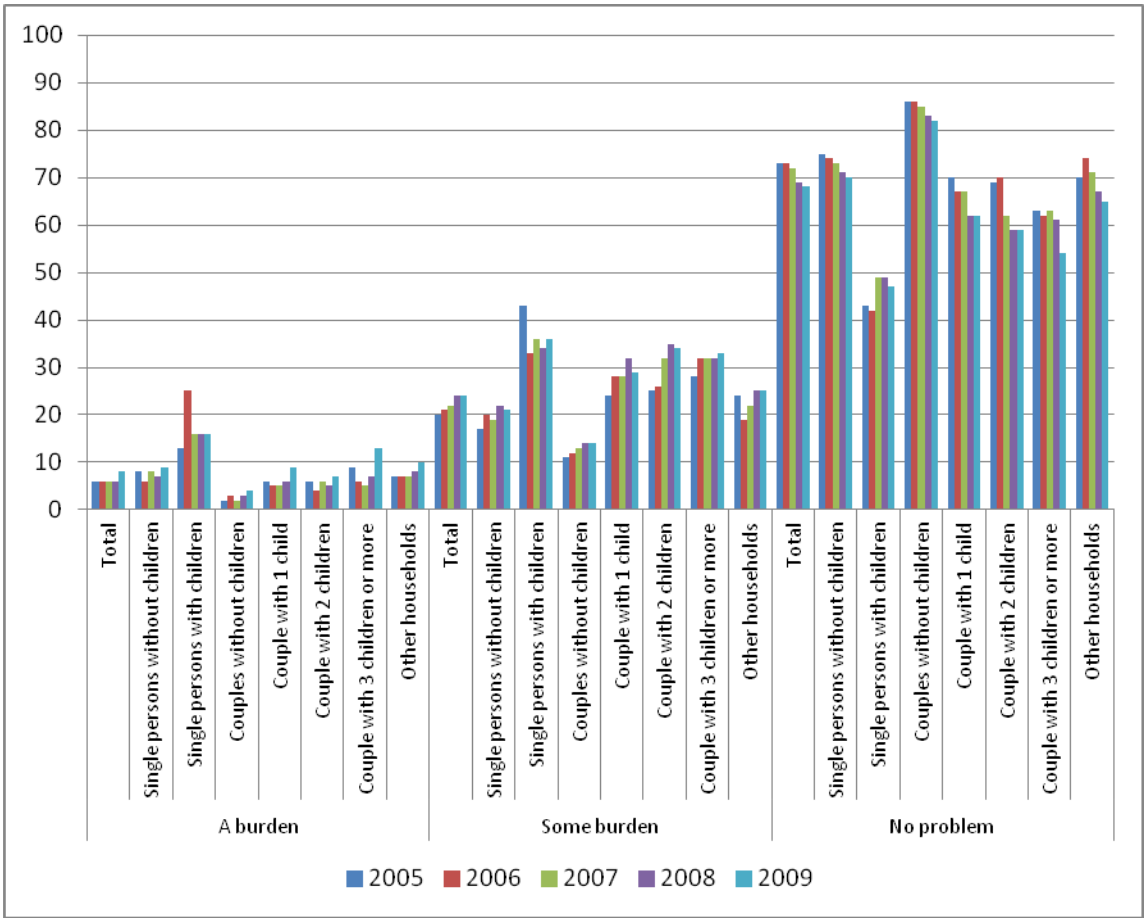
It is obviouse that households with a financial burden problem will have lower ability to re-pay any loan, moreover, they will have problems in making end meet.

The situation in Denmark is a little better than in the UK. Only 10 % of all households were in the financial burden problem (compared to 20% in UK in 2005, Consumer Affairs Directorate, 2001, 2003). However, the difference in results can be explained by the difference in methodology in calculations, which are not known to me.

From the survey, the biggest group of persons with the financial burden problem consists of persons from 16- 24 years old. They are the least creditworthy borrowers. Households without financial burden problem represent the best creditworthy borrowers. The 60 year old and over have the best position, therefore, they are the best creditworthy borrowers.

Financial Burden Problem Across Type of Households

Figure 50 Distribution of a burden problem across household type, in % of all households from the survey

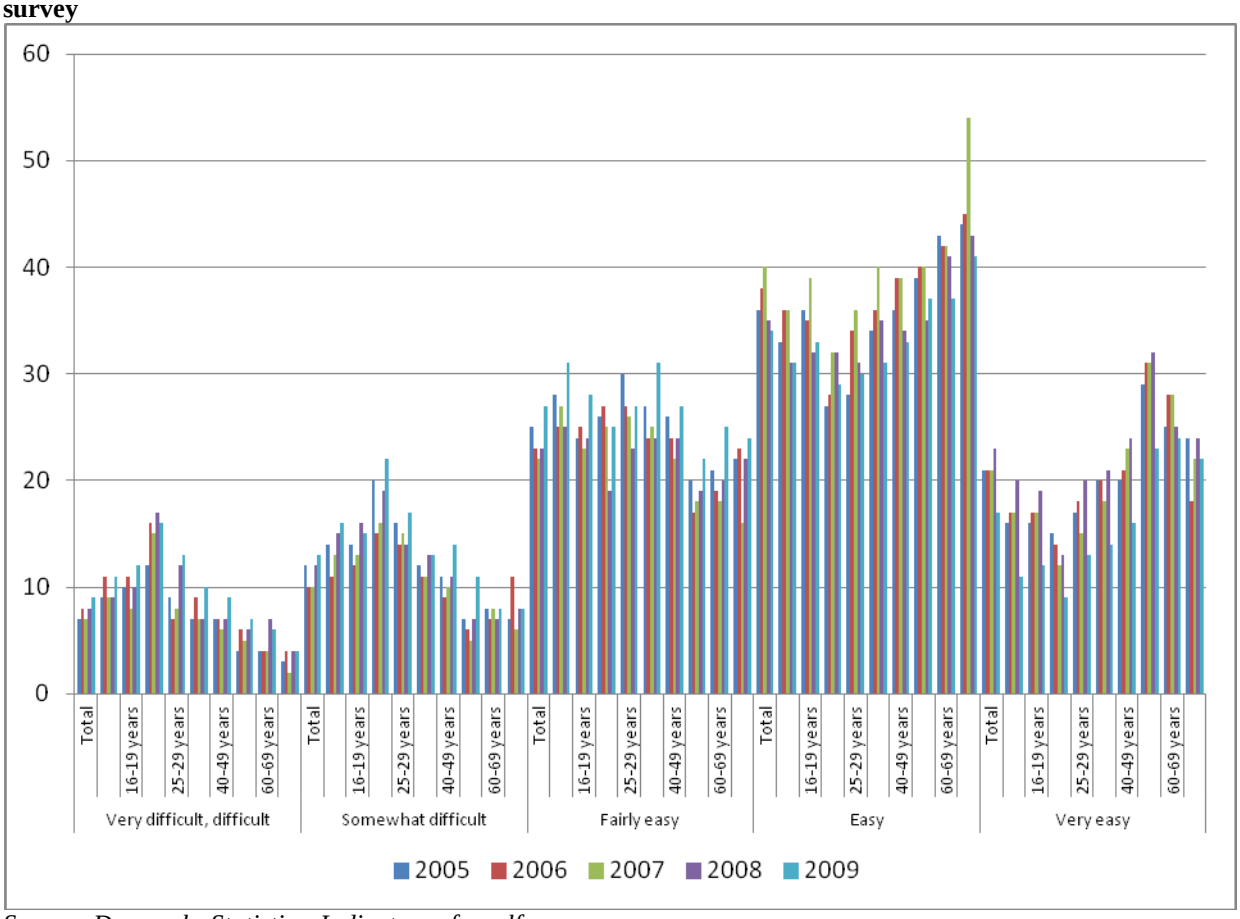


Source: Danmarks Statistics, Indicators of wealfare

Appendix 25A: The Ability of Households to Make Ends Meet

The Ability of Households to Make Ends Meet across Age and Time

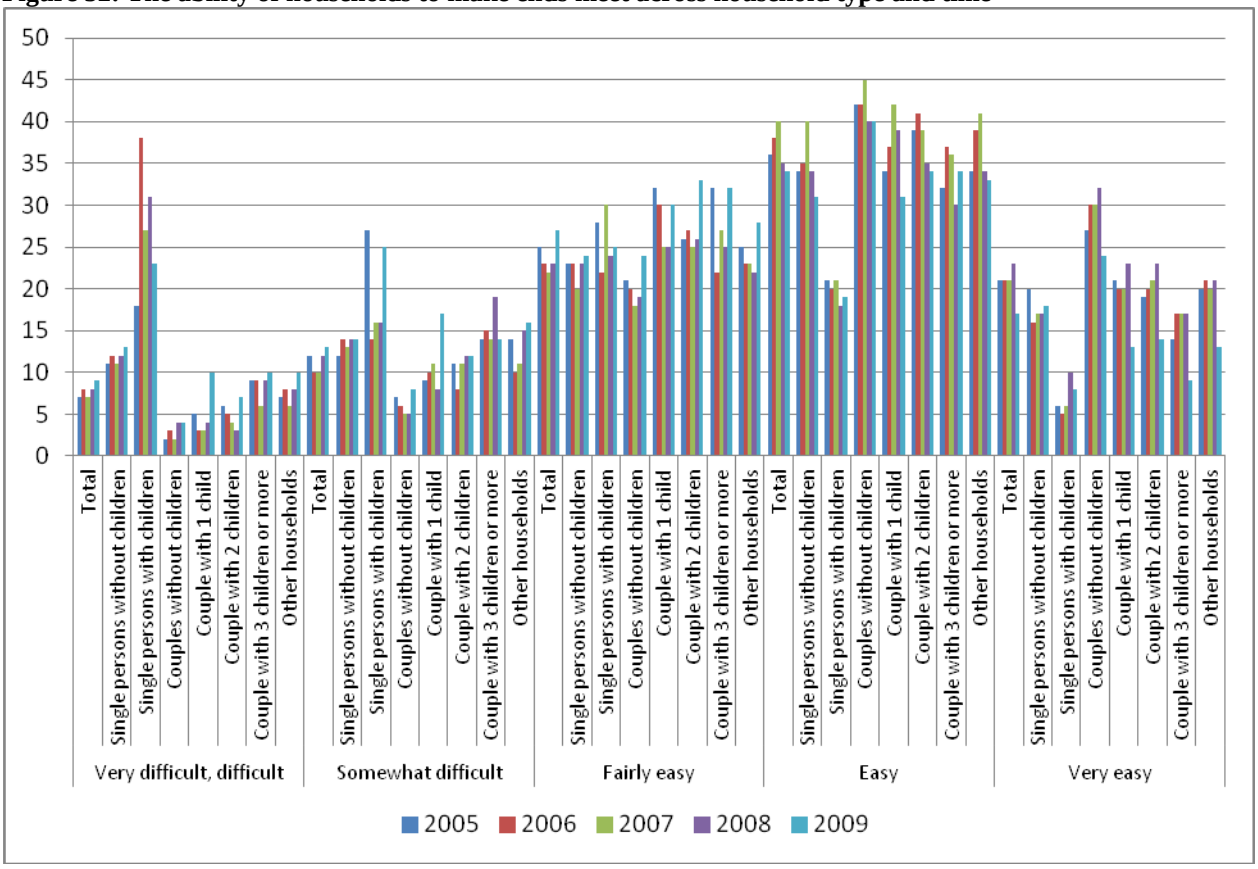
Figure 51: The ability of households to make ends meet across age and time, in % of all households from the survey



Source: Danmarks Statistics, Indicators of wealfare

The ability of households to make ends meet across household type and time

Figure 52: The ability of households to make ends meet across household type and time



Source: Danmarks Statistics, Indicators of wealfare

Appendix 26A: Mortgage Interest Payment and Interest Burden Developments in Denmark

Table 4: Total mortgage credit lending and interest payments, Denmark

	DKK million	%	%	DKK million	%
	Mortgage credit lending All maturities/unspecified	Growth rate in mortgage credit lending,	The National banks official rates – Lending,	Interest Payments	Growth in interest payments
1993	4.361.889,00		9,48	405.476,14	
1994	4.199.261,00	-3,80	5,70	236.983,19	-53,71
1995	4.339.008,00	3,27	5,77	250.886,25	5,70
1996	4.700.194,00	8,00	3,76	173.870,73	-36,67
1997	5.153.540,00	9,21	3,56	184.031,39	5,68
1998	5.813.336,00	12,05	4,07	238.744,25	26,03
1999	6.391.260,00	9,48	3,11	194.834,77	-20,32
2000	6.764.698,00	5,68	4,60	320.148,15	49,66
2001	7.320.343,00	7,89	4,70	337.977,94	5,42
2002	8.044.230,00	9,43	3,47	278.034,53	-19,52
2003	8.832.776,00	9,35	2,42	208.668,89	-28,70
2004	9.458.107,00	6,84	2,15	203.349,30	-2,58
2005	10.412.973,00	9,62	2,17	226.383,89	10,73
2006	11.765.870,00	12,22	3,03	364.943,19	47,75
2007	12.932.217,00	9,45	4,10	535.349,73	38,32
2008	13.826.536,00	6,69	4,48	622.509,57	15,08
2009	14.429.362,00	4,27	1,78	239.246,75	-95,63
2010	14.948.013,00	3,53	1,05	156.954,14	-42,15

Source: Danmarks Statistics, Danmarks Nationalbank and own calculations

Appendix 27A: Actual Interest Receivable (by banks and mortgage credit institutes) and Effective Interest rate

Figure 53 Interest receivable by Danish banks

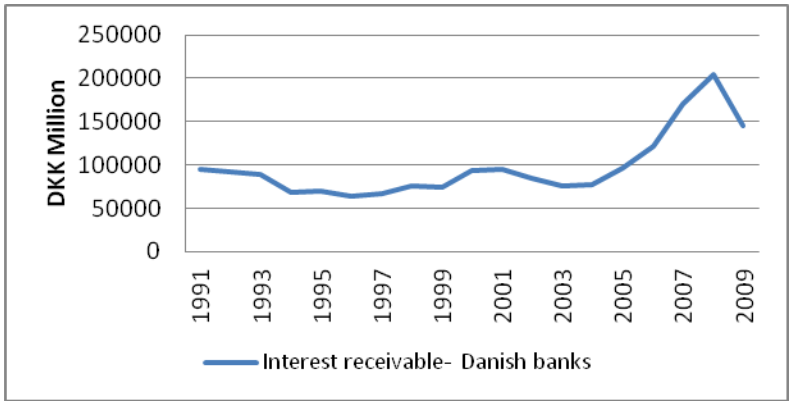


Figure 54 Interest receivable by mortgage credit institutes

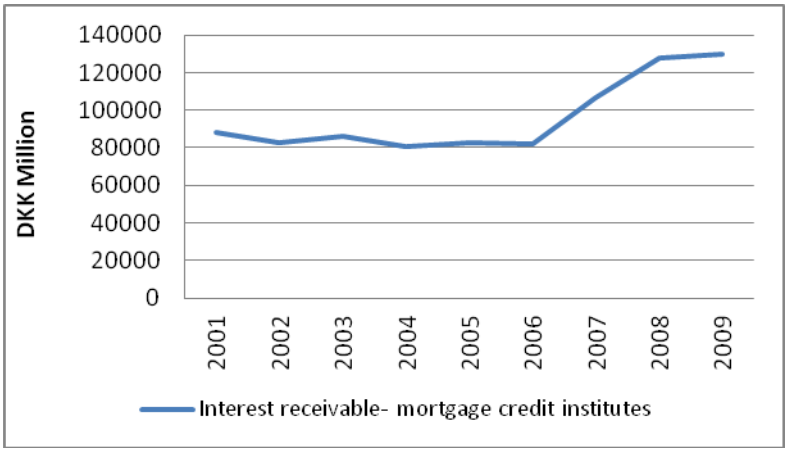
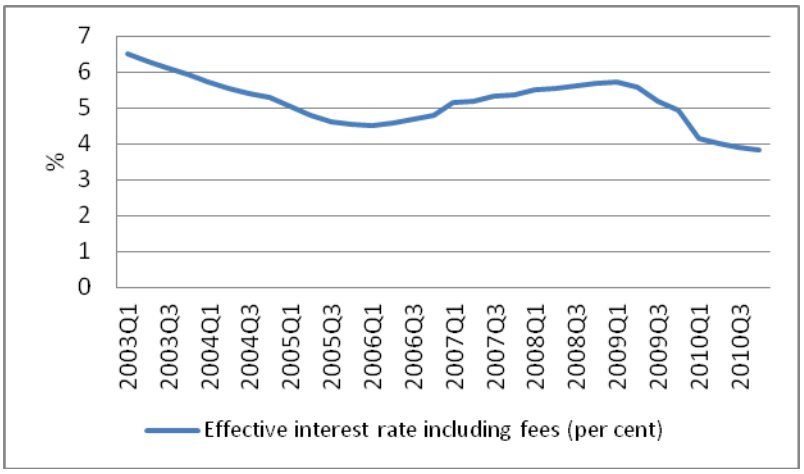


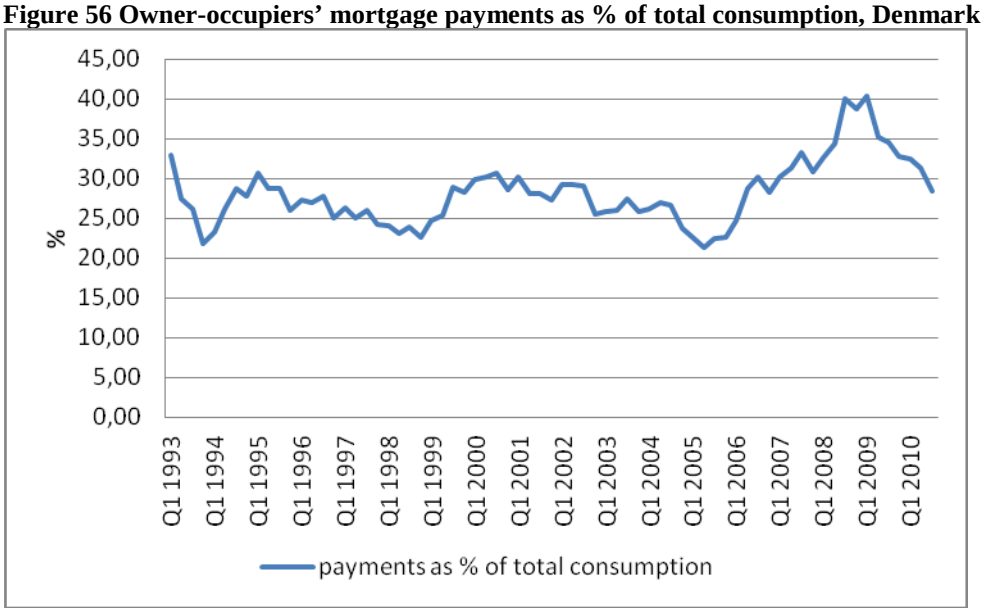
Figure 55 Effective interest rate including fees



Source to all table: Consolidated profit and loss accounts, Danmarks Statistics

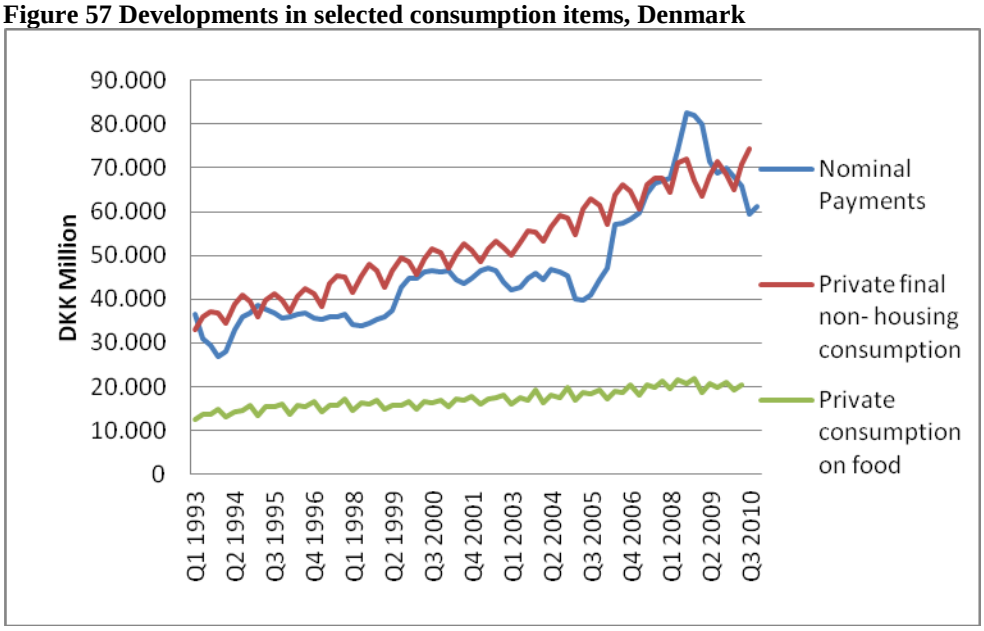
Appendix 28A: Mortgage Debt Payments and Households Consumption- a Comparison

Figure 56 Owner-occupiers' mortgage payments as % of total consumption, Denmark



Source: Danmarks Statistics and own creation

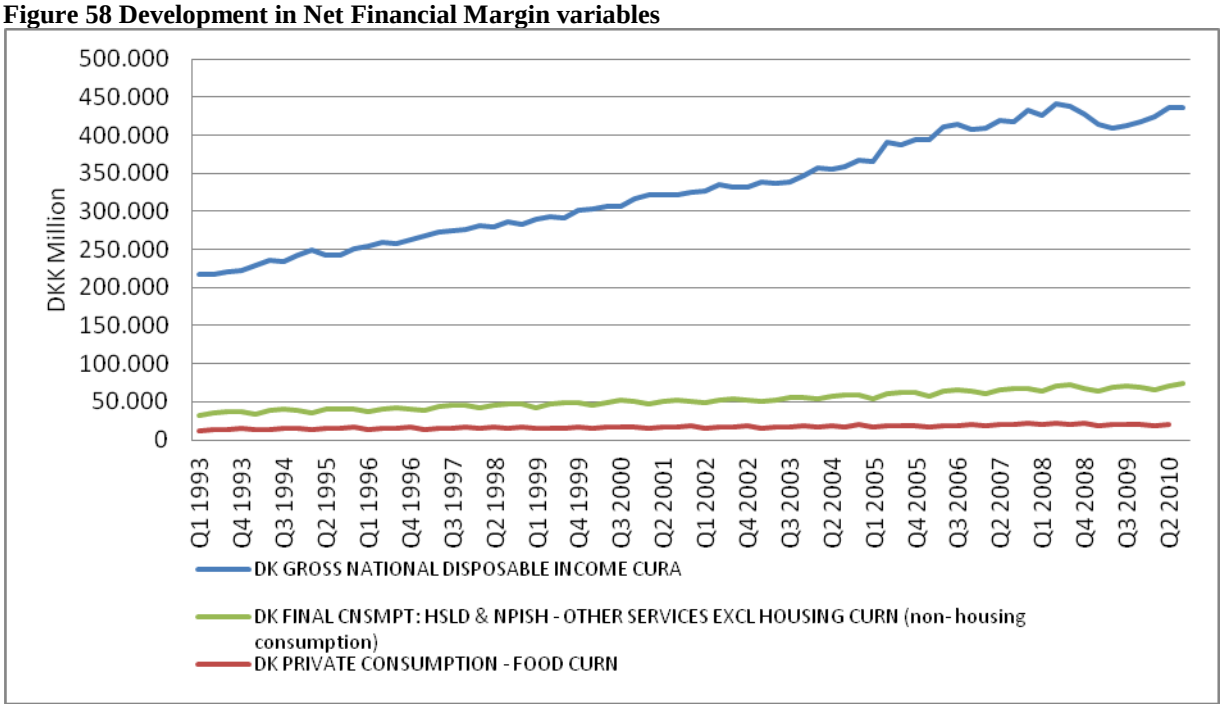
Figure 57 Developments in selected consumption items, Denmark



Source: Danmarks Statistics and own calculations

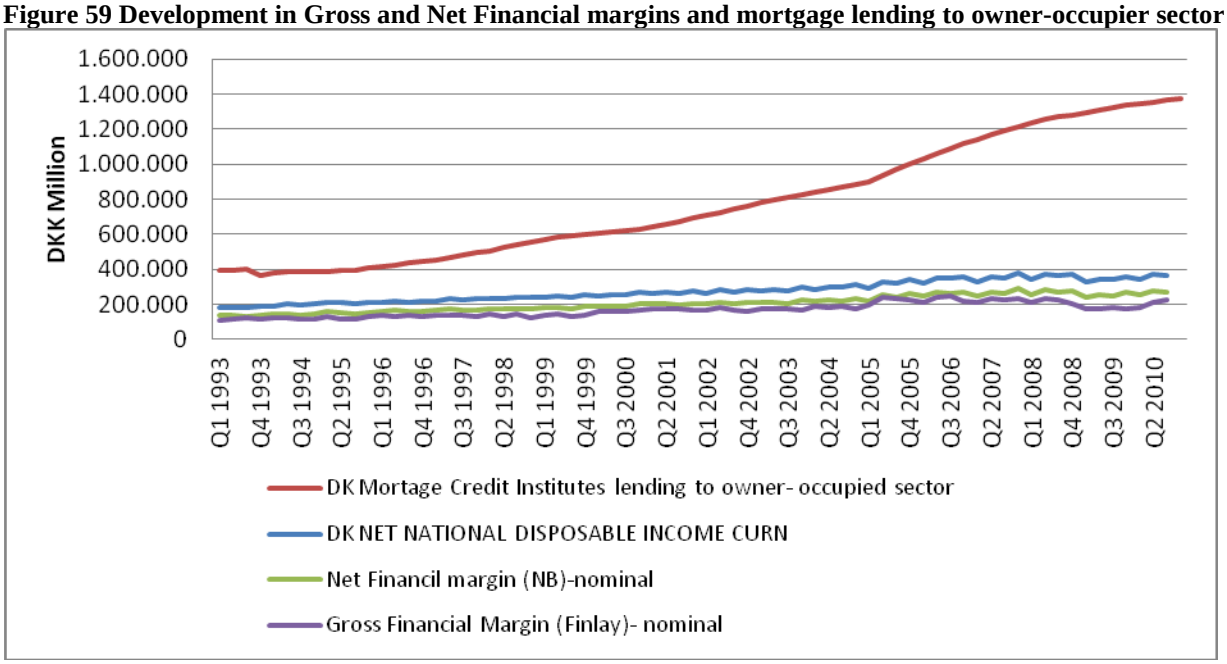
Appendix 29A: Net Financial Margin Variables Development and Mortgage- Institutes Lending to Owner- Occupied Sector

Figure 58 Development in Net Financial Margin variables



Source: Danmarks Statistics

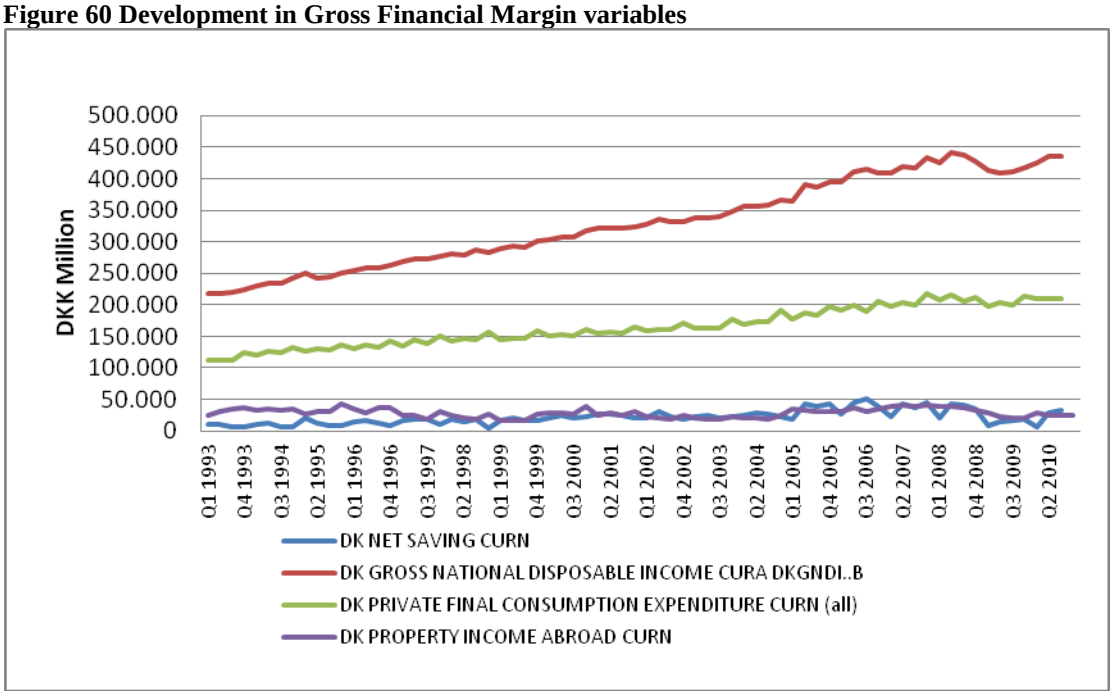
Figure 59 Development in Gross and Net Financial margins and mortgage lending to owner-occupier sector



Source: Danmarks Statistics and own calculations

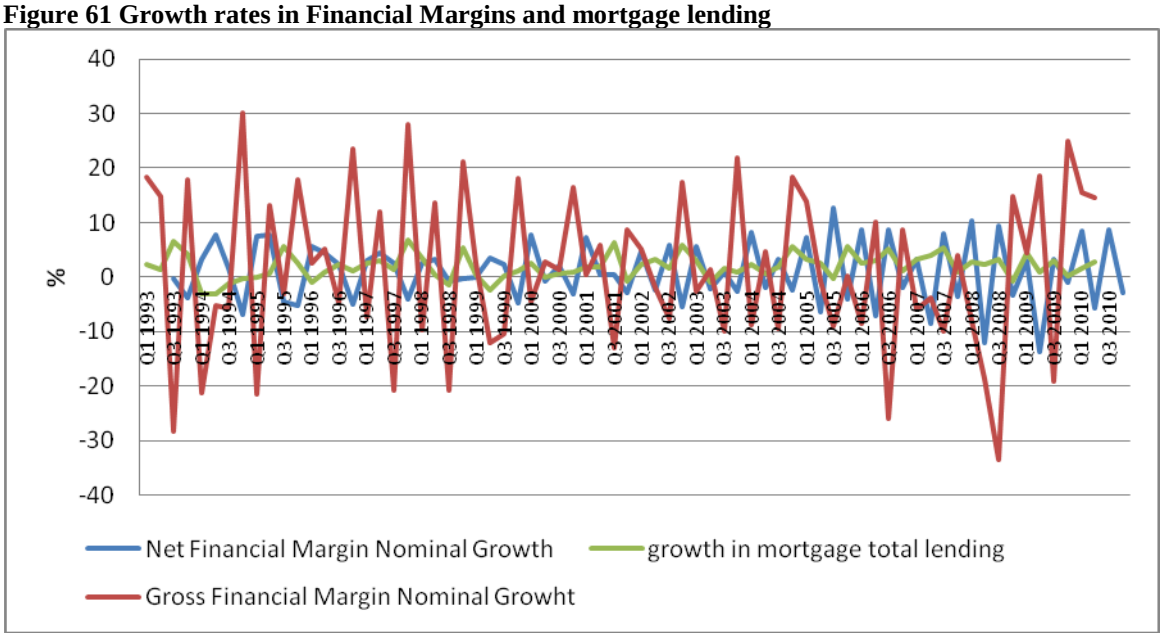
Appendix 30A: Gross Financial Margin Variables Development and Mortgage- Institutes Lending to Owner- Occupied Sector

Figure 60 Development in Gross Financial Margin variables



Source: Danmarks Statistics

Figure 61 Growth rates in Financial Margins and mortgage lending



Source: own calculations

Appendix 31A: Income and Credit Affordability

Higher income improves credit affordability:
Income is the most important explanatory variable in housing affordability measure (ECB, 2003, Structural factors in the EU Housing markets).
In credit affordability measure it is also one of the most important variables that influence households ability to pay a debt (Hollo, Pap, 2007). The income level determines what families can afford to buy (or borrow) (Lunde,, 2008b). It also reflects the costs share of income associated with the debt servicing (higher income decreases cost share of income, making loans more affordable on a monthly basis). Thus, it is generally accepted that higher income improves credit affordability.
However, in the next box I provide count-argumentation.

Growth in income, however, does not always mean that households will borrow more, because they can afford more. A combination of income and current indebtedness, a life style, psychology and life cycle determines its affordability power. (Hansen *et al*., 2009)
First of all, households might use extra income to *reduce its indebtedness* (especially in times of over-indebtedness). At a higher indebtedness, extra income might used to reduce household's debt (see *the Economis* 2010a)
The willingness of households' to reduce its over-indebtedness might pose a lack of demand for credits. In the recent paper Carmen and Vincent Reinhart estimate that in the past crises it took an average of seven years for households and business to bring their debts and debt service back to tolerable levels relative to income (The Economist, October9th, 20010, a special report on the world economy) (See also Lunde, Financial Soundness Indicators, p. 57 on reduced indebtedness)
Secondly, higher income provide *extra cash /finances* that otherwise would be borrowed.
Finlay (Finlay 2009) concluded that the people who are most likely to respond to promotional activity (increase credit demand) by applying for credit are those who are least creditworthy and have the greatest risk of defaulting on any credit they are subsequently granted (here, I assume, because of low income)
Conversely, the most creditworthy people tend not to need or want credit. There are might be many underlying explanations for this phenomenon. However, I use this statement as a foundation to propose a hypothesis on negative relationship between income and lending.
Moreover, growth in income stimulates consumption and investment. Thus, a higher share of income can be reserved for consumption, debt re-payment, etc. Income, therefore, will not always be used to re-pay a loan.
At last, increase in income and its effect on demand for credit and its affordability will be different depending on the *state of economy*, *expectations*, *saving behavior*, as well.
Increased income in boom times and over-optimism leads to lower savings and higher spending, influencing households' credit affordability in the negative manner. While decreased income in bust times spark pessimism about future, which in turn can be reflected by increase in saving behavior. Therefore, the affordability will be improved (her I ignore the macro economic factors, such as unemployment, foreclosure and house price fluctuation)
Consequently, growth in income might change dynamics in the borrowing behaviour. For example, growth in income and its affect on affordability will be different depending on a range of factors. **So, for the credit affordability, the general level of income only will not provide sufficient information.**

Appendix 32A: Financial Margin Developments across Demographics

Methodology in calculations:
On a household level, the Net Financial Margin is derived as disposable income less minimum consumption cost (I assumed that consumption expenditure in food, beverages, clothing and food wear constitute minimum consumption expenditure).
The Gross Financial Margin is derived as disposable income less consumption costs (such as food and beverages, clothing, electricity and fuel, housing-related costs, medicine, transportation costs and financial expenses).
At a level below zero, households have no capacity to service its debt

Net and Gross Financial Margins across households types

Figure 62: Net Financial Margin development, Denmark

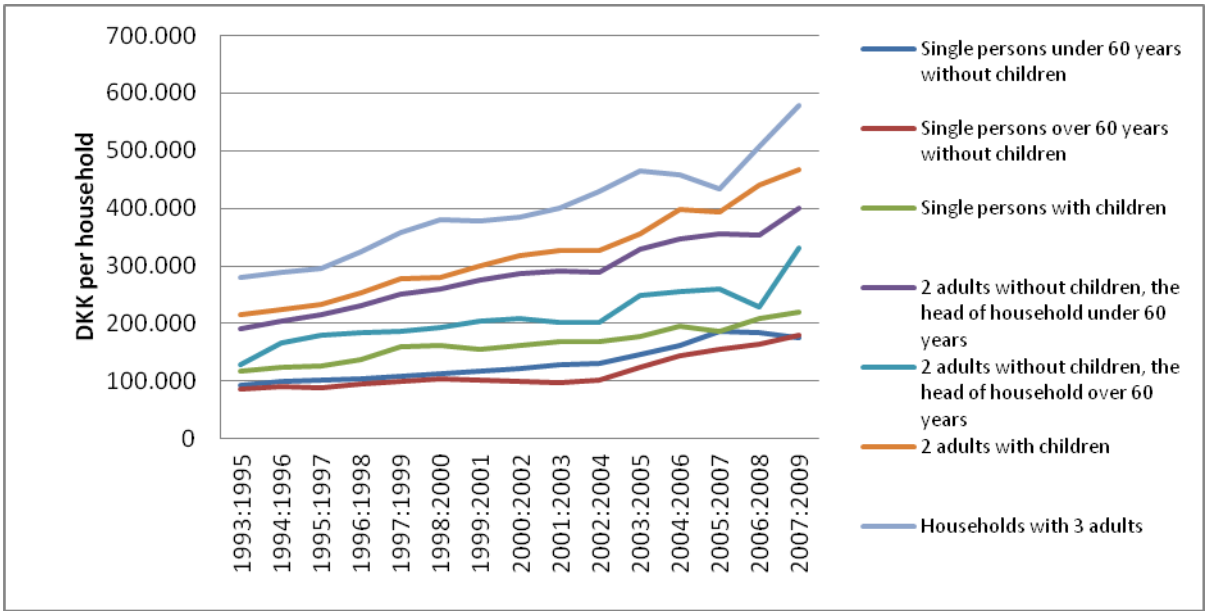
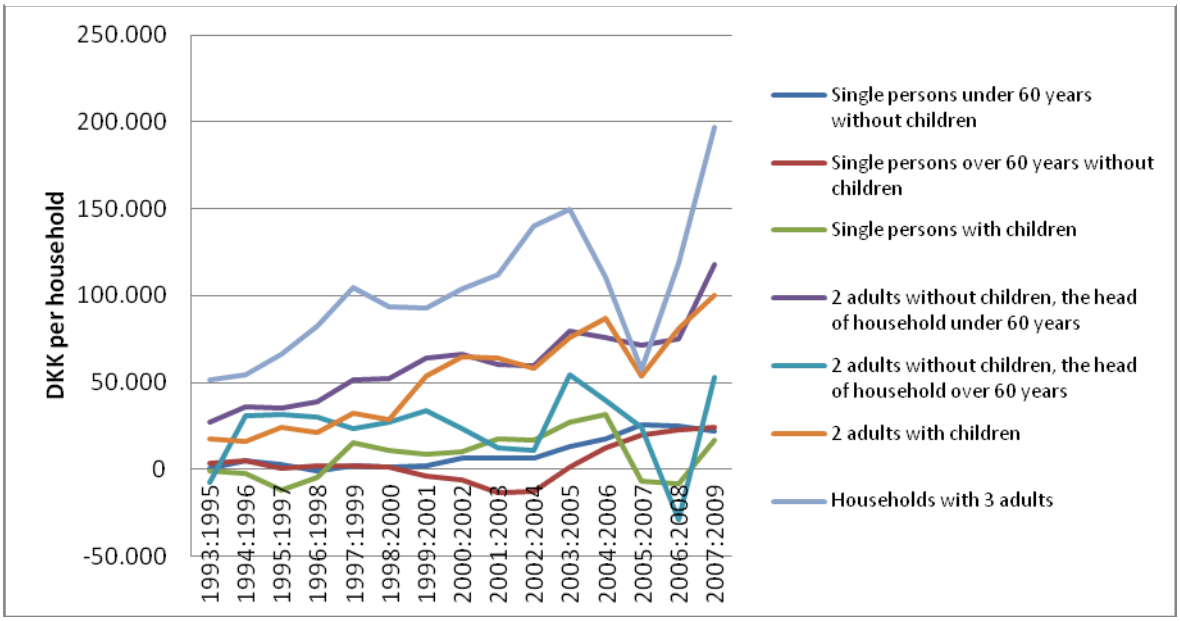


Figure 63: Gross Financial Margin development, Denmark



Net and Gross Financial Margins across socioeconomic status of the main income earner

Figure 64: Net Financial margin development, Denmark

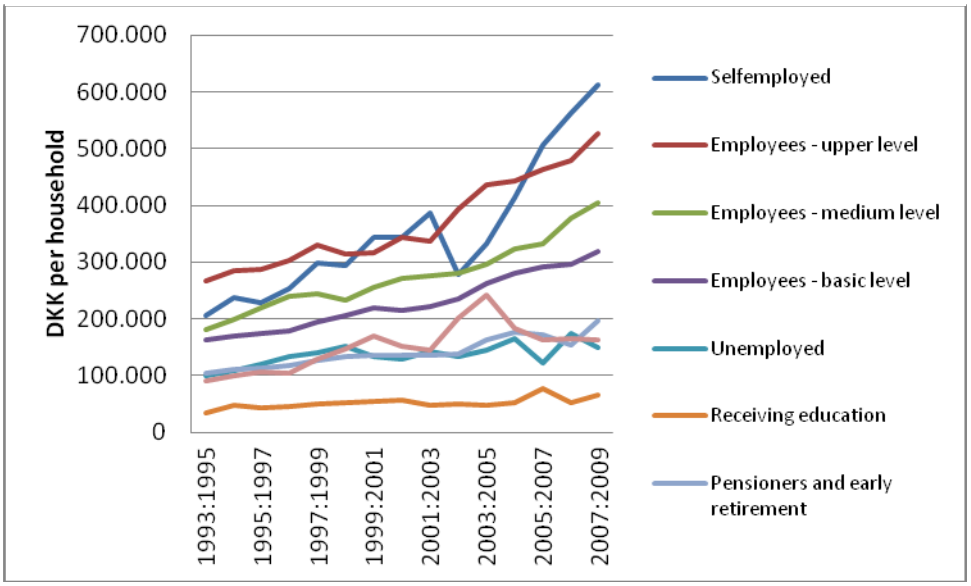
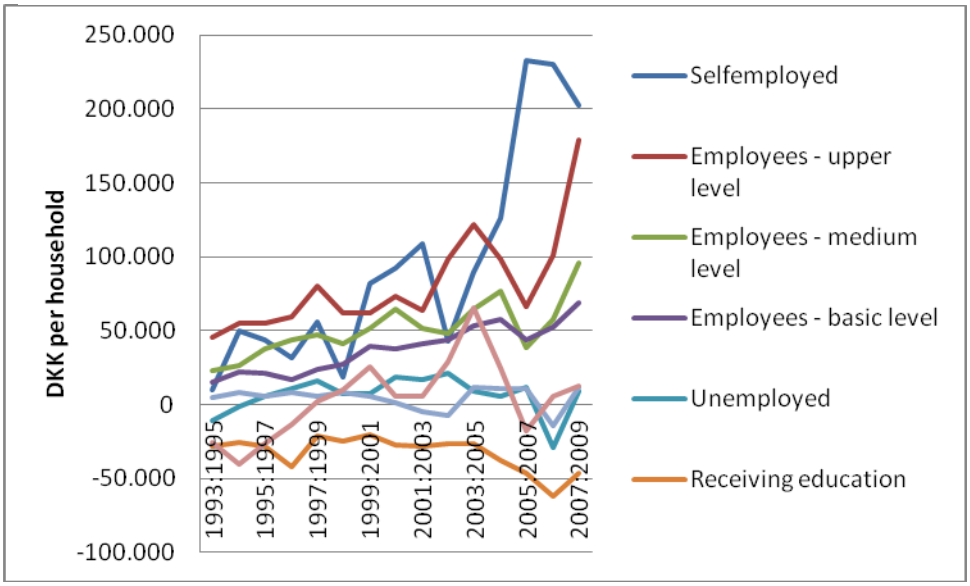


Figure 65: Gross Financial margin development, Denmark



Source: Danmarks Statistics and own calculations

Net and Gross Financial Margins developments across different income level groups

Figure 66: Net Financial Margin, Denmark

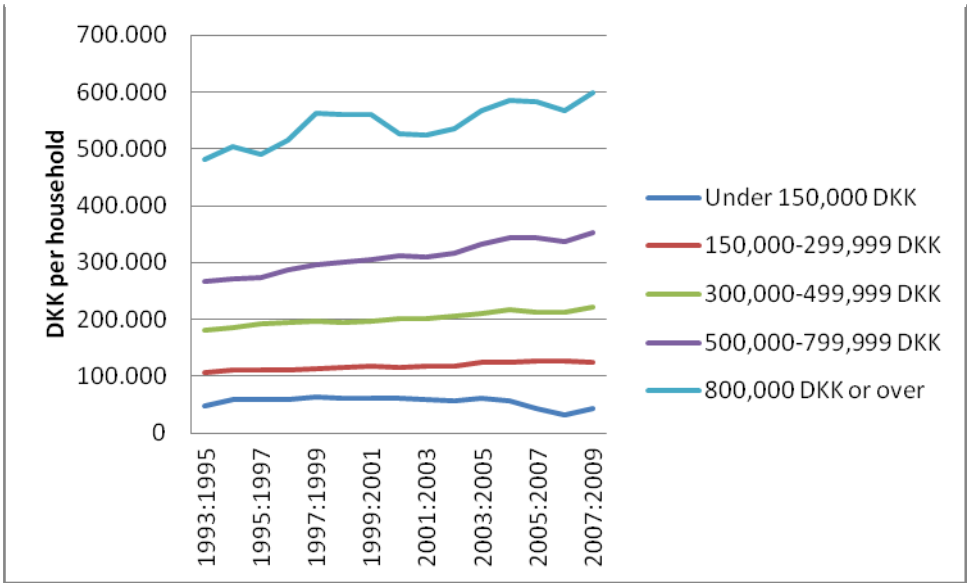
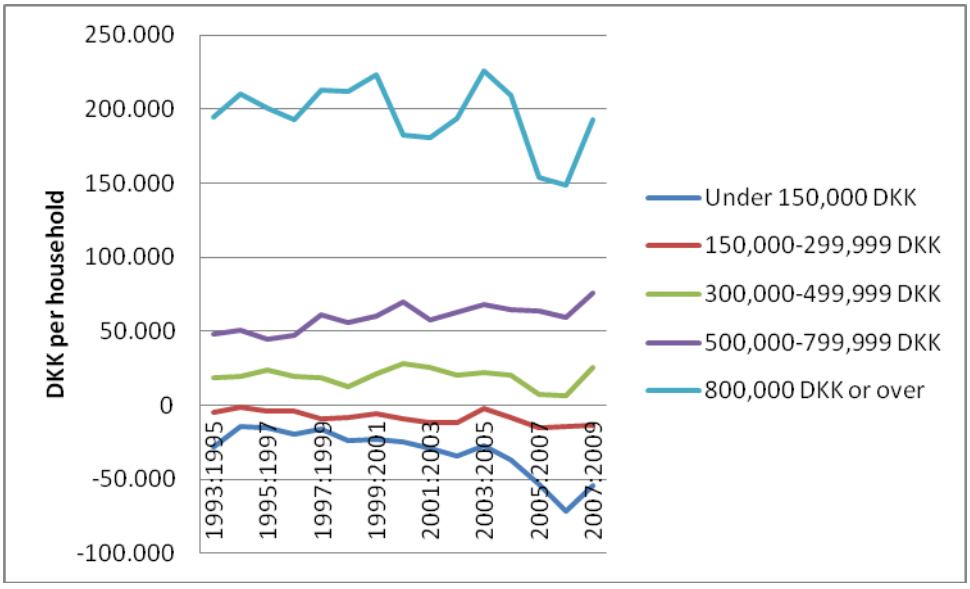


Figure 67: Gross Financial Margin, Denmark



Source: Danmarks Statistics and own calculations

Net and Gross Financial Margins across dwelling types

Figure 68: Net Financial Margin, Denmark

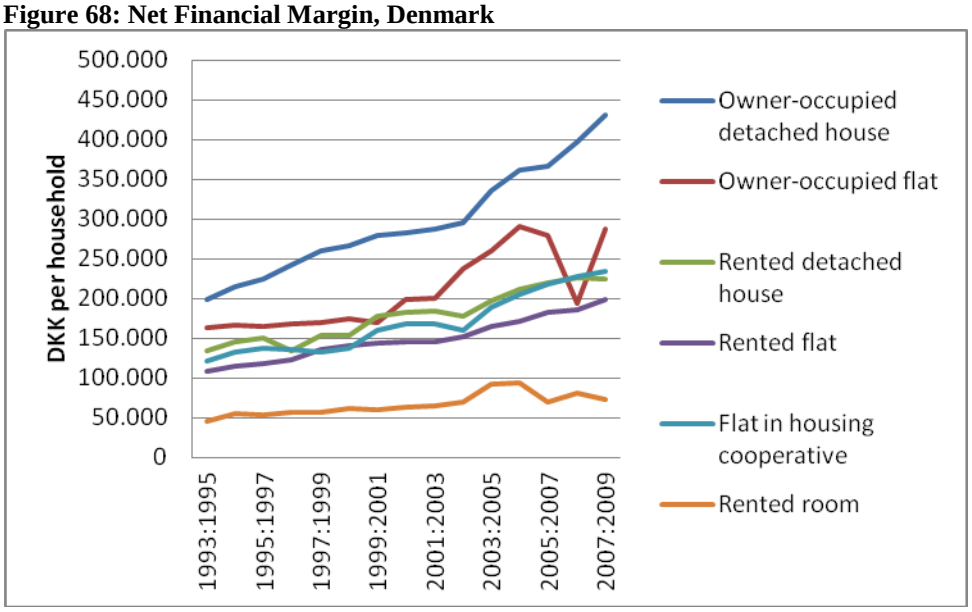
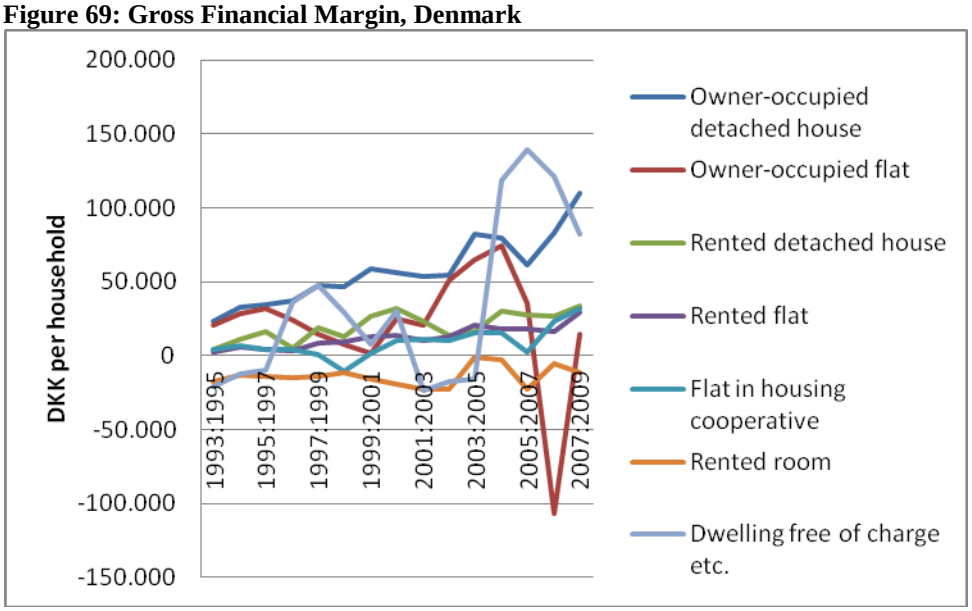


Figure 69: Gross Financial Margin, Denmark



Source: Danmarks Statistics and own calculations

Notes to appendix 32 A

Applying the Net Financial and Gross Financial Margins, I have demonstrated how households' (for different demographic groups) financial vulnerability and the ability to service the debt had developed in Denmark during 1993- 2009 period.

By applying Net Financial Margin, households are seemed to be more financial strong, as all groups achieved a margin above zero. However, by applying Gross Financial Margin, I can outline more financially vulnerable households. Among them are the groups who are receiving education, living in rented room, and income group, that earn below DKK 300. 000. Correspondingly, these groups represent 1,8 %, 2,4 % and 30 % of all households in Denmark. (See also appendix 34 A, figures 71- 75)
Since 2005, flat owner-occupiers became the most financially vulnerable households. Thus, they are the "biggest threat" to housing market and financial instability. At a margin below zero, they are unable to service their debt. However, they represent only 5 per cent of all households in Denmark.

Appendix 34A: Sensitivity Analysis

Tabel 4: Estimated housing prices for 2010 at different interest rates and tax shields

Interest rate (30- year mortgage credit yield), %	2,0	2,5	3,0	3,5	4,5	5,0	5,5	6,0
Estimated price, DKK thousand	1720	1671	1625	1539	1500	1462	1427	1393
Tax shield (the tax value of deductible interest payments)	0,76	0,70	0,50	0,40	0,30	0,20	0,10	0,00
Estimated price(DDK Thousand)	1454	1461	1486	1499	1511	1524	1538	1551

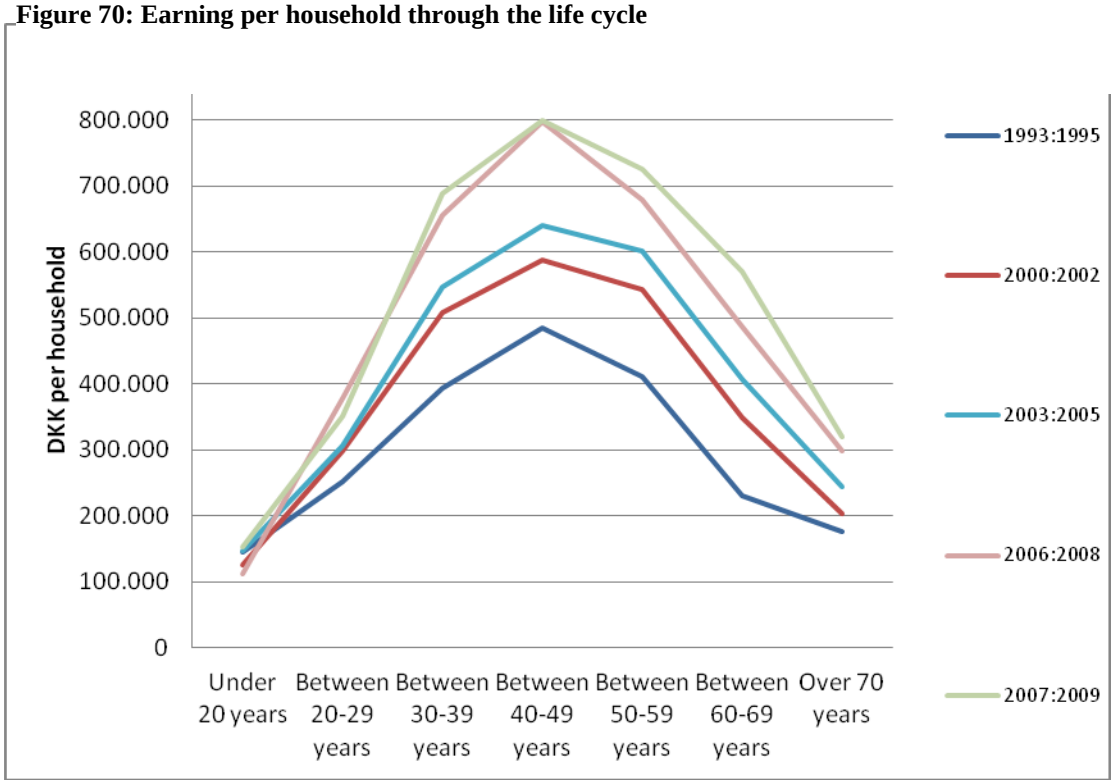
Source: my own creation

For example, an increase in interest rate by 1% leads to a decline in housing prices by 5%.

Appendix 35A: Supplementary Figures

Earnings distribution across age indicates that the growth in income is strongest from 29 until 39. After 39, the average earnings still are increasing, but at a slower pace.
Accordingly to earnings distribution across age, the 30- 39 year old have the best housing and credit affordability.

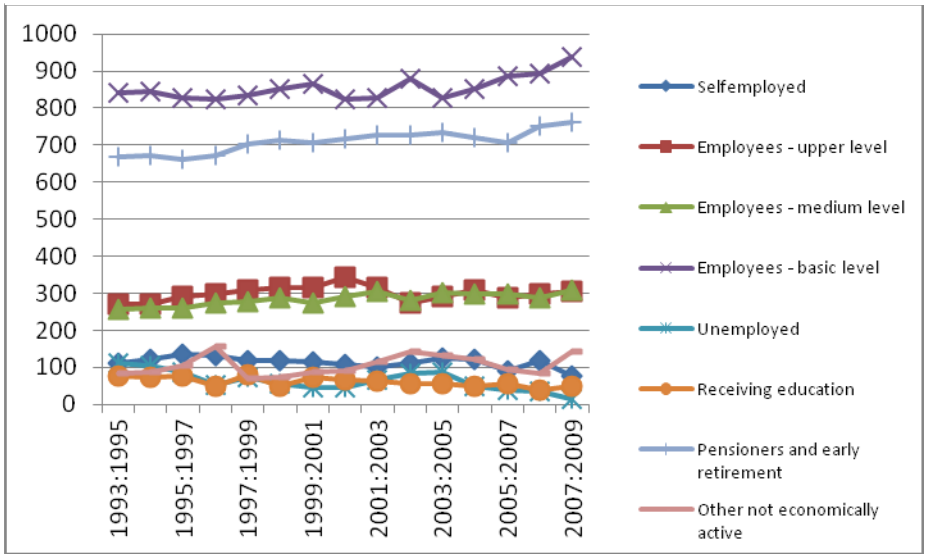
Figure 70: Earning per household through the life cycle

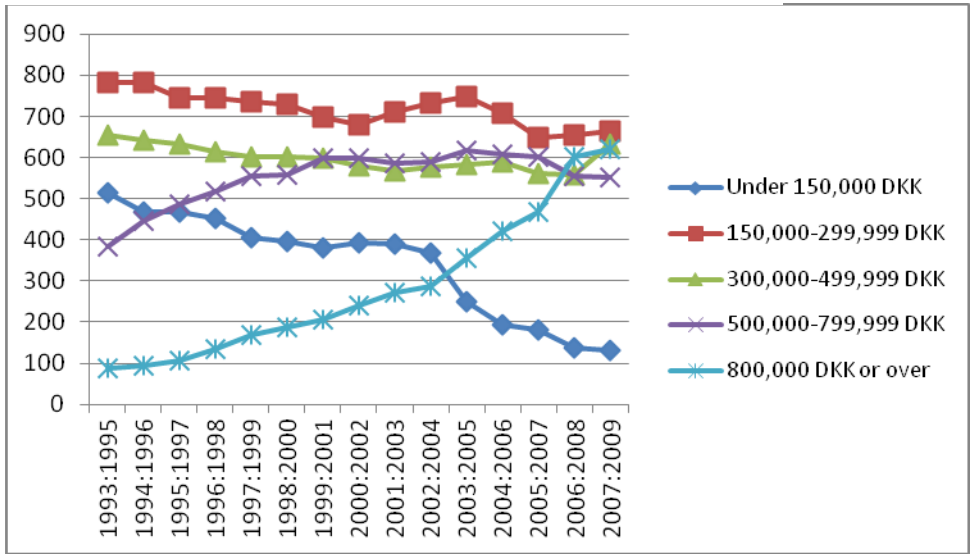


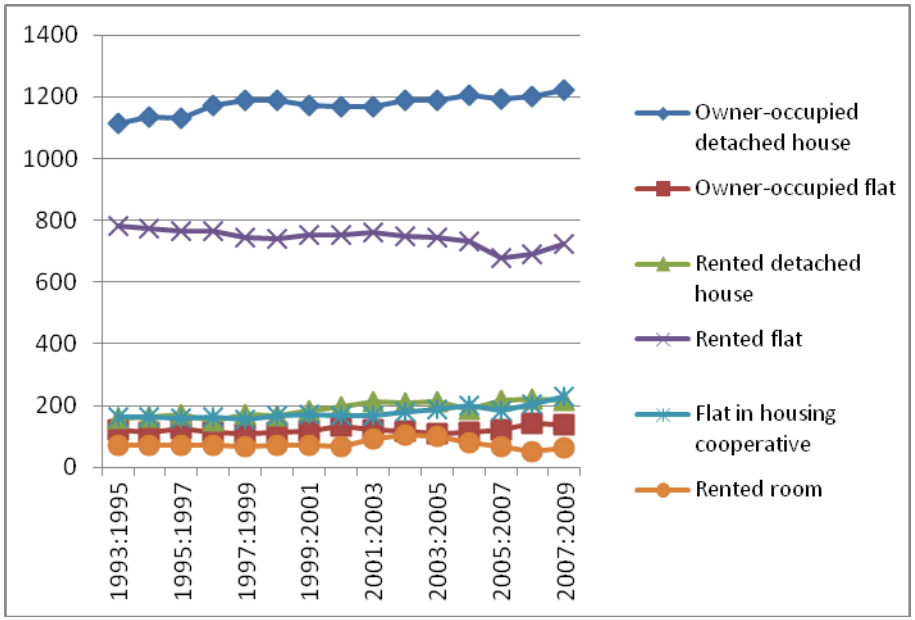
Source: Denmarks Statistics

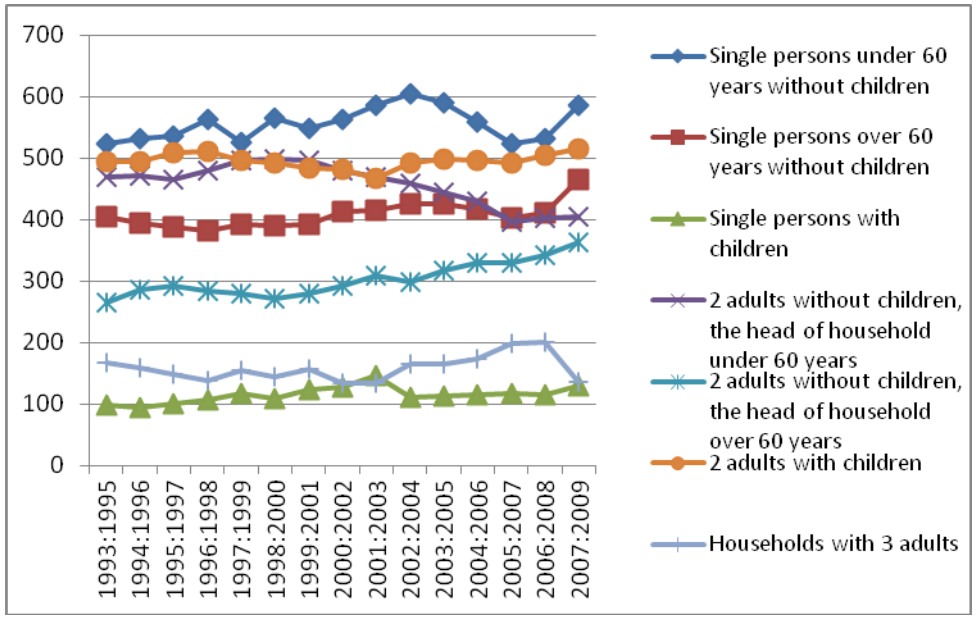
Figure 71-74 Households in Denmark- thousands

Source: Danmarks Statistics









Appendix B

Data

Table 2: Model Family Characteristics, Denmark

Source: Danmarks Statistics, "Investigation of Consumption"

		1993:1995	1994:1996	1995:1997	1996:1998	1997:1999	1998:2000	1999:2001	2000:2002	2001:2003	2002:2004	2003:2005	2004:2006	2005:2007	2006:2008	Average
Owner-occupied detached house	Households in the survey	1366	1821	1594	1318	1213	1196	1178	1110	1129	1079	1043	1101	1215	1272	1259
	Households in Denmark - thousands	1114,7	1134,2	1131,1	1172,6	1190,8	1189,9	1172,7	1167,4	1167,5	1187,9	1189,4	1206,3	1191,4	1200,1	1172
	Persons per household	2,6	2,6	2,5	2,6	2,6	2,6	2,6	2,5	2,5	2,6	2,5	2,5	2,6	2,7	2,5
	Of whom adults	1,9	1,9	1,9	1,9	1,9	1,9	1,9	1,9	1,9	1,9	1,9	1,9	1,9	1,9	1,9
	Of whom children	0,6	0,6	0,6	0,7	0,7	0,7	0,6	0,7	0,6	0,7	0,6	0,6	0,7	0,7	0,65
	Of whom homeowners	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Age of head of household	50,3	50,8	50,9	50,9	50,8	51,1	51,5	52,2	52,8	52,4	52,4	52,1	51,2	51,2	51,4
	Size of dwelling, square metre	119,3	125,4	130,1	137,8	136	135,5	134,9	135,1	135,5	138,4	139,7	142,8	149,1	143,7	135,9
	Year of construction	1949,6	1949	1947,8	1946	1948	1947,2	1949,3	1948,4	1949,3	1945,3	1944,2	1946,8	1943,4	1949	1947
Owner-occupied flat	Households in the survey	166	215	198	160	149	145	150	164	166	177	162	165	160	168	167
	Households in Denmark - thousands	121	114,9	125,2	114,5	107,9	115,2	119	133,8	121,2	115,5	110,8	111,1	120,8	140,6	119
	Persons per household	1,9	1,8	1,7	1,6	1,6	1,6	1,6	1,7	1,6	1,6	1,6	1,8	1,8	1,8	1,7
	Of whom adults	1,6	1,5	1,4	1,4	1,4	1,4	1,4	1,5	1,4	1,4	1,4	1,5	1,4	1,5	1,4
	Of whom children	0,3	0,3	0,3	0,2	0,2	0,2	0,2	0,3	0,3	0,1	0,2	0,3	0,4	0,3	0,2
	Of whom homeowners	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Age of head of household	41,8	41,6	43,3	42,2	44,1	43,5	42,2	42,8	42,9	46	46,5	47,4	46	47,7	44,1
	Size of dwelling, square metre	90,1	86,9	83,8	81,8	82,9	83,3	78,7	80,3	78,4	81,7	81,5	86,2	95,9	89,1	84,3
	Year of construction	1946,8	1945,3	1946	1940,9	1939,2	1936	1941,1	1941,4	1934,3	1939,5	1934,3	1937,9	1947,6	1941,1	1940,8
total in DK	Households in Denmark - thousands	2421,9	2432,5	2441	2462,2	2463,6	2470,5	2481,7	2491,6	2523,9	2553,9	2553,3	2520,8	2459,2	2506,1	2484,
	Persons in Denmark - thousands	5099,1	5119,4	5154,3	5211,8	5271,9	5207,5	5249,3	5215,8	5208,4	5346,6	5365,4	5364,8	5323,5	5452,2	5256,4
	Persons per household	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,2	2,2	2,1
	Of whom adults	1,7	1,7	1,6	1,6	1,7	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,7	1,7	1,63
	Of whom children	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
	Of whom homeowners	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
	Age of head of household	47,6	47,7	47,8	47,8	48,4	48,4	48,5	49,2	49,3	49,6	49,8	50	49,9	50,2	48,8
	Size of dwelling, square metre	104,8	106,3	106,7	105,9	105,8	105,8	104,7	105	104,3	105,2	106,3	108,9	117,9	112,4	107,1
	Year of construction	1948,8	1948,2	1948	1946,3	1947,5	1946,8	1948,9	1948,5	1949	1947	1946,8	1949,5	1949,9	1949,2	1948,1

Table 2: Income, Housing prices and Price-to-income ratios, Denmark

Name	Nominal Housing prices- total sales, DKK Thousand	Nominal Housing price index- total, Q1=100	Nominal Gross National Income, DKK Million	Gross National Income index, Q1=100	Det National Disposable Income, DKK Million	Net disposable income index, Q1=100	Inflation, %	Real houisng price- total sales, DKK Thousand	Real gross national income, DKK Million	Real net disposable income, DKK Million	Price- to- gross national income (Price/Income)	Price- net disposable income (Price/Income)	Affordability Index; long- term average= 100	Real change in Housing price, %	Real change in gross disposable income, %
Q1 1992	636	100,00	219702	100,00	181541	100,00	2,32	622	214720	177425	289,48	350,33	78,3		
Q2 1992	610	95,91	218734	99,56	183460	101,06	2,5	595	213399	178985	278,88	332,50	75,5	-4,35	-0,62
Q3 1992	594	93,40	224370	102,12	181345	99,89	2,09	582	219777	177632	264,74	327,55	71,6	-2,26	2,94
Q4 1992	650	102,20	223345	101,66	182794	100,69	1,51	640	220023	180075	291,03	355,59	78,8	9,58	0,11
Q1 1993	683	107,39	221872	100,99	180845	99,62	1,35	674	218917	178436	307,84	377,67	83,3	5,11	-0,50
Q2 1993	681	107,08	221739	100,93	184621	101,70	0,94	675	219674	182902	307,12	368,86	83,1	0,11	0,35
Q3 1993	608	95,60	225042	102,43	180784	99,58	1,18	601	222417	178676	270,17	336,31	73,1	-11,58	1,24
Q4 1993	709	111,48	228699	104,10	185978	102,44	1,53	698	225253	183175	310,01	381,23	83,9	15,02	1,27
Q1 1994	701	110,22	234592	106,78	192592	106,09	1,8	689	230444	189187	298,82	363,98	80,9	-1,40	2,28
Q2 1994	644	101,26	240026	109,25	200700	110,55	1,99	631	235343	196784	268,30	320,88	72,6	-8,67	2,10
Q3 1994	664	104,40	240742	109,58	193009	106,32	2,1	650	235790	189039	275,81	344,03	74,6	2,95	0,19
Q4 1994	707	111,16	247187	112,51	203451	112,07	2,09	693	242127	199286	286,02	347,50	77,4	6,28	2,65
Q1 1995	679	106,76	254543	115,86	209455	115,38	2,35	663	248699	204646	266,75	324,17	72,2	-4,30	2,68
Q2 1995	672	105,66	250037	113,81	208491	114,85	2,29	657	244439	203823	268,76	322,32	72,7	-0,98	-1,73
Q3 1995	649	102,04	248920	113,30	201736	111,12	1,87	637	244351	198033	260,73	321,71	70,6	-3,07	-0,04
Q4 1995	736	115,72	255139	116,13	209443	115,37	1,89	722	250406	205558	288,47	351,41	78,1	12,56	2,45
Q1 1996	731	114,94	259292	118,02	211397	116,45	1,84	718	254607	207578	281,92	345,79	76,3	-0,63	1,66
Q2 1996	730	114,78	263494	119,93	220982	121,73	1,98	716	258378	216692	277,05	330,34	75,0	-0,27	1,47
Q3 1996	730	114,78	262759	119,60	214456	118,13	2,28	714	256902	209675	277,82	340,40	75,2	-0,29	-0,57
Q4 1996	812	127,67	270286	123,02	219160	120,72	2,34	793	264106	214149	300,42	370,51	81,3	10,59	2,77
Q1 1997	772	121,38	272773	124,16	221334	121,92	2,15	756	267032	216675	283,02	348,79	76,6	-4,87	1,10
Q2 1997	780	122,64	278074	126,57	232802	128,24	2,09	764	272381	228036	280,50	335,05	75,9	1,09	1,98
Q3 1997	778	122,33	278725	126,87	227445	125,29	2,41	760	272166	222093	279,13	342,06	75,5	-0,57	-0,08
Q4 1997	896	140,88	280135	127,51	232660	128,16	2,14	877	274266	227785	319,85	385,11	86,6	14,39	0,77
Q1 1998	875	137,58	287518	130,87	232227	127,92	2,06	857	281715	227540	304,33	376,79	82,4	-2,29	2,68

Q2 1998	892	140,25	284321	129,41	236441	130,24	1,97	875	278828	231873	313,73	377,26	84,9	2,01	-1,03
Q3 1998	849	133,49	290321	132,14	238211	131,22	1,68	835	285524	234275	292,43	356,41	79,1	-4,66	2,37
Q4 1998	1046	164,47	288311	131,23	237718	130,94	1,71	1028	283464	233721	362,80	440,02	98,2	20,84	-0,72
Q1 1999	966	151,89	294908	134,23	237509	130,83	2,02	947	289069	232806	327,56	406,72	88,6	-8,26	1,96
Q2 1999	948	149,06	300446	136,75	246729	135,91	2,25	927	293835	241300	315,53	384,23	85,4	-2,11	1,64
Q3 1999	937	147,33	300426	136,74	241142	132,83	2,63	913	292727	234962	311,89	388,57	84,4	-1,54	-0,38
Q4 1999	1120	176,10	307464	139,95	254982	140,45	3	1087	298509	247555	364,27	439,25	98,6	17,48	1,96
Q1 2000	1109	174,37	310176	141,18	248919	137,11	3,13	1075	300762	241364	357,54	445,53	96,8	-1,11	0,75
Q2 2000	1095	172,17	315168	143,45	258245	142,25	3,23	1061	305307	250165	347,43	424,02	94,0	-1,37	1,50
Q3 2000	1032	162,26	315402	143,56	254272	140,06	2,74	1004	306990	247491	327,20	405,86	88,5	-5,45	0,55
Q4 2000	1153	181,29	325861	148,32	268211	147,74	2,61	1124	317572	261389	353,83	429,89	95,7	11,21	3,39
Q1 2001	1149	180,66	325612	148,21	263645	145,23	2,36	1123	318105	257566	352,87	435,81	95,5	-0,10	0,17
Q2 2001	1156	181,76	328770	149,64	269713	148,57	2,57	1127	320532	262955	351,61	428,60	95,1	0,40	0,76
Q3 2001	1113	175,00	329753	150,09	265899	146,47	2,4	1087	322024	259667	337,53	418,58	91,3	-3,62	0,46
Q4 2001	1283	201,73	332641	151,41	275121	151,55	2,08	1257	325863	269515	385,70	466,34	104,4	14,53	1,18
Q1 2002	1172	184,28	332204	151,21	265513	146,26	2,5	1143	324101	259037	352,80	441,41	95,5	-9,46	-0,54
Q2 2002	1191	187,26	344184	156,66	282075	155,38	2,27	1165	336544	275814	346,04	422,23	93,6	1,83	3,77
Q3 2002	1187	186,64	339483	154,52	272724	150,23	2,34	1160	331721	266488	349,65	435,24	94,6	-0,40	-1,44
Q4 2002	1261	198,27	340650	155,05	283414	156,12	2,59	1229	332050	276259	370,17	444,93	100,2	5,80	0,10
Q1 2003	1256	197,48	345189	157,12	274942	151,45	2,79	1222	335820	267479	363,86	456,82	98,5	-0,59	1,13
Q2 2003	1307	205,50	344791	156,94	281078	154,83	2,29	1278	337072	274785	379,07	465,00	102,6	4,47	0,37
Q3 2003	1262	198,43	347370	158,11	277492	152,85	1,84	1239	341094	272478	363,30	454,79	98,3	-3,06	1,19
Q4 2003	1468	230,82	354770	161,48	296837	163,51	1,45	1447	349699	292594	413,79	494,55	112,0	15,50	2,49
Q1 2004	1443	226,89	363363	165,39	287803	158,53	0,94	1430	359979	285123	397,12	501,38	107,5	-1,21	2,90
Q2 2004	1414	222,33	366028	166,60	299897	165,20	1,09	1399	362081	296663	386,31	471,50	104,5	-2,18	0,58
Q3 2004	1384	217,61	367984	167,49	296738	163,46	1,22	1367	363549	293161	376,10	466,40	101,8	-2,27	0,40
Q4 2004	1611	253,30	375543	170,93	314664	173,33	1,4	1589	370358	310320	428,98	511,97	116,1	15,01	1,86
Q1 2005	1760	276,73	374148	170,3	293002	161,40	1,24	1738	369565	289413	470,40	600,68	127,3	9,00	-0,21
Q2 2005	1718	270,13	396972	180,69	330998	182,33	1,69	1689	390375	325497	432,78	519,04	117,1	-2,86	5,48
Q3 2005	1737	273,11	393964	179,32	322764	177,79	2,22	1699	385408	315754	440,90	538,16	119,3	0,58	-1,28

Q4 2005	1924	302,52	401723	182,85	344290	189,65	2,09	1885	393499	337242	478,94	558,83	129,6	10,35	2,08
Q1 2006	2087	328,14	403894	183,84	319304	175,89	2,05	2045	395780	312890	516,72	653,61	139,8	8,17	0,58
Q2 2006	2111	331,92	418163	190,33	350015	192,80	1,99	2070	410004	343186	504,83	603,12	136,6	1,20	3,53
Q3 2006	2067	325,00	422983	192,53	346594	190,92	1,84	2030	415341	340332	488,67	596,38	132,2	-1,96	1,29
Q4 2006	2331	366,51	417062	189,83	355305	195,72	1,68	2292	410171	349435	558,91	656,06	151,2	12,18	-1,25
Q1 2007	2309	363,05	419285	190,84	327140	180,20	1,89	2266	411508	321072	550,70	705,81	149,0	-1,15	0,33
Q2 2007	2144	337,11	427298	194,49	355644	195,90	1,63	2110	420445	349940	501,76	602,85	135,8	-7,16	2,15
Q3 2007	2232	350,94	426923	194,32	347277	191,29	1,18	2206	421944	343227	522,81	642,71	141,5	4,47	0,36
Q4 2007	2291	360,22	439999	200,27	376988	207,66	2,16	2243	430696	369017	520,68	607,71	140,9	1,65	2,05
Q1 2008	2325	365,57	433776	197,44	339190	186,84	3,03	2257	421019	329215	535,99	685,46	145,0	0,63	-2,27
Q2 2008	2263	355,82	448715	204,24	373542	205,76	3,5	2186	433541	360910	504,33	605,82	136,5	-3,16	2,93
Q3 2008	1980	311,32	445354	202,71	364415	200,73	4,15	1901	427608	349894	444,59	543,34	120,3	-13,99	-1,38
Q4 2008	2095	329,40	435996	198,45	368570	203,02	2,92	2036	423626	358113	480,51	568,41	130,0	6,83	-0,94
Q1 2009	2027	318,71	422378	192,25	325983	179,56	1,83	1991	414787	320125	479,90	621,81	129,9	-2,23	-2,11
Q2 2009	1847	290,41	417312	189,94	340762	187,71	1,27	1824	412079	336489	442,59	542,02	119,8	-8,75	-0,66
Q3 2009	1842	289,62	420043	191,19	340708	187,68	0,98	1824	415967	337401	438,53	540,64	118,7	0,02	0,94
Q4 2009	1884	296,23	426439	194,10	360843	198,77	1,24	1861	421216	356423	441,80	522,11	119,6	2,00	1,25
Q1 2010	1973	310,22	433982	197,53	340519	187,57	2,05	1933	425264	333679	454,63	579,41	123,0	3,82	0,96
Q2 2010	1877	295,13	444177	202,17	370653	204,17	2,11	1838	434999	362994	422,58	506,40	114,4	-5,05	2,26
Q3 2010	1942	305,35	445161	202,62	366368	201,81	2,4	1896	434728	357781	436,25	530,07	118,0	3,12	-0,06
Q4 2010	1893	297,64	464243	211,31	388442	213,97	2,63	1844	452346	378488	407,76	487,33	110,3	-2,78	3,97

Source: Danish Statistics, DataStream and own calculations

Table 3: Total Sales, 1-family owner-occupier house and flat owner-occupier quarterly prices, Denmark

	Period	inflation rate, %	Total Sales-Nominal Price, DKK Thousand	real price Total sale, DKK Thousand	1- family houses; Nominal DKK Thousand	Real price, 1-family houses, DKK Thousand	owner-occupied flats, nominal price, DKK Thousand	Real price, Owner-occupied flats, DKK Thousand
	Q1 1992	2,32	636	622	560	547	432	422
	Q2 1992	2,5	610	595	568	554	439	428
	Q3 1992	2,09	594	582	537	526	412	404
	Q4 1992	1,51	650	640	531	523	398	392
	Q1 1993	1,35	683	674	526	519	396	391
	Q2 1993	0,94	681	675	543	538	408	404
Pre-boom	Q3 1993	1,18	608	601	571	564	419	414
	Q4 1993	1,53	709	698	605	596	442	435
	Q1 1994	1,8	701	689	629	618	466	458
	Q2 1994	1,99	644	631	627	615	464	455
	Q3 1994	2,1	664	650	615	602	442	433
	Q4 1994	2,09	707	693	616	603	439	430
	Q1 1995	2,35	679	663	630	616	458	447
	Q2 1995	2,29	672	657	661	646	477	466
	Q3 1995	1,87	649	637	648	636	475	466
	Q4 1995	1,89	736	722	687	674	485	476
	Q1 1996	1,84	731	718	719	706	497	488
	Q2 1996	1,98	730	716	744	730	520	510
	Q3 1996	2,28	730	714	755	738	514	503
	Q4 1996	2,34	812	793	793	775	525	513
	Q1 1997	2,15	772	756	792	775	521	510
	Q2 1997	2,09	780	764	803	787	544	533
	Q3 1997	2,41	778	760	806	787	534	521
	Q4 1997	2,14	896	877	823	806	547	536
	Q1 1998	2,06	875	857	870	852	614	602
	Q2 1998	1,97	892	875	900	883	634	622
	Q3 1998	1,68	849	835	869	855	626	616
	Q4 1998	1,71	1046	1028	897	882	654	643
	Q1 1999	2,02	966	947	933	915	698	684
	Q2 1999	2,25	948	927	969	948	725	709
	Q3 1999	2,63	937	913	947	923	717	699
	Q4 1999	3	1120	1087	968	940	726	705
	Q1 2000	3,13	1109	1075	1022	991	778	754
	Q2 2000	3,23	1095	1061	1044	1011	811	786
	Q3 2000	2,74	1032	1004	1058	1030	811	789
	Q4 2000	2,61	1153	1124	1066	1039	840	819
	Q1 2001	2,36	1149	1123	1109	1083	883	863
	Q2 2001	2,57	1156	1127	1124	1096	907	884

	Q3 2001	2,4	1113	1087	1091	1065	914	893
	Q4 2001	2,08	1283	1257	1091	1069	931	912
	Q1 2002	2,5	1172	1143	1135	1107	960	937
	Q2 2002	2,27	1191	1165	1158	1132	983	961
	Q3 2002	2,34	1187	1160	1143	1117	983	961
	Q4 2002	2,59	1261	1229	1138	1109	1014	988
	Q1 2003	2,79	1256	1222	1156	1125	1011	984
	Q2 2003	2,29	1307	1278	1205	1178	1039	1016
Boom	Q3 2003	1,84	1262	1239	1213	1191	1055	1036
	Q4 2003	1,45	1468	1447	1219	1202	1105	1089
	Q1 2004	0,94	1443	1430	1283	1271	1158	1147
	Q2 2004	1,09	1414	1399	1347	1332	1200	1187
	Q3 2004	1,22	1384	1367	1330	1314	1191	1177
	Q4 2004	1,4	1611	1589	1366	1347	1270	1252
	Q1 2005	1,24	1760	1738	1427	1410	1354	1337
	Q2 2005	1,69	1718	1689	1490	1465	1418	1394
	Q3 2005	2,22	1737	1699	1522	1489	1482	1450
	Q4 2005	2,09	1924	1885	1612	1579	1587	1555
	Q1 2006	2,05	2087	2045	1718	1683	1784	1748
	Q2 2006	1,99	2111	2070	1781	1746	1800	1765
Bust	Q3 2006	1,84	2067	2030	1748	1716	1741	1710
	Q4 2006	1,68	2331	2292	1741	1712	1703	1675
	Q1 2007	1,89	2309	2266	1795	1762	1689	1658
	Q2 2007	1,63	2144	2110	1841	1811	1698	1671
	Q3 2007	1,18	2232	2206	1834	1813	1696	1676
	Q4 2007	2,16	2291	2243	1796	1758	1606	1572
	Q1 2008	3,03	2325	2257	1851	1797	1834	1780
	Q2 2008	3,5	2263	2186	1904	1840	1742	1683
	Q3 2008	4,15	1980	1901	1776	1705	1613	1549
	Q4 2008	2,92	2095	2036	1696	1648	1529	1486
	Q1 2009	1,83	2027	1991	1691	1661	1486	1459
	Q2 2009	1,27	1847	1824	1756	1734	1487	1468
	Q3 2009	0,98	1842	1824	1770	1753	1542	1527
	Q4 2009	1,24	1884	1861	1818	1796	1646	1626
	Q1 2010	2,05	1973	1933	1824	1787	1664	1631
	Q2 2010	2,11	1877	1838	1862	1824	1709	1674
	Q3 2010	2,4	1931	1886	1811	1769	1659	1620
	Q4 2010	2,63	1893	1844	1833	1786	1708	1664

Source: Danish Statistics and own calculations

Table 4: Total Sales, 1-family owner-occupier house and flat owner-occupier yearly prices, Denmark

Name	DK HOUSE PRICES - 1 FAMILY HOUSES , DKK THOUSAND	DK HOUSE PRICES - OWNER OCCUPIED FLATS, DKK THOUSAND	DK HOUSE PRICES - TOTAL SALE , DKK THOUSAND	DK HOUSE PRICES - 1 FAMILY HOUSES , GROWTH RATE, %	DK HOUSE PRICES - OWNER OCCUPIED FLATS, GROWTH RATE, %	DK HOUSE PRICES - TOTAL SALE , GROWTH RATE, %
1992	531	398	650			
1993	605	442	709	13,05	10,49	8,69
1994	616	439	707	1,80	-0,68	-0,28
1995	687	485	736	10,91	9,96	4,02
1996	793	525	812	14,35	7,92	9,83
1997	823	547	896	3,71	4,11	9,84
1998	897	654	1046	8,61	17,87	15,48
1999	968	726	1120	7,62	10,44	6,84
2000	1066	840	1153	9,64	14,59	2,90
2001	1091	931	1283	2,32	10,29	10,68
2002	1138	1014	1261	4,22	8,54	-1,73
2003	1219	1105	1468	6,88	8,59	15,20
2004	1366	1270	1611	11,39	13,92	9,30
2005	1612	1587	1924	16,56	22,28	17,76
2006	1741	1703	2331	7,70	7,05	19,19
2007	1796	1606	2291	3,11	-5,86	-1,73
2008	1696	1529	2095	-5,73	-4,91	-8,94
2009	1818	1646	1884	6,95	7,37	-10,62
2010	1833	1708	1893	0,82	3,70	0,48

Source: DataStream and Statistics Denmark

Table 5: Price-to-earned Income ratio and affordability index, house and flat owner-occupiers, Denmark

	Earned Income, DKK per household		Price-to- income		Affordability Index =(Price-Earned Income/(Price-Earned Income Average))*100	
	Owner-occupied detached house	Owner-occupied flat	Owner-occupied detached house	Owner-occupied flat	Owner-occupied detached house	Owner-occupied flat
1993:1995	304582,9	272128	225,55	178,22	77,6	56,1
1994:1996	315152,4	262849	251,62	199,73	86,5	62,9
1995:1997	325605,3	243320,3	252,76	224,81	86,9	70,8
1996:1998	351851,8	241544	254,94	270,76	87,7	85,2
1997:1999	370798,6	247646,8	261,06	293,16	89,8	92,3
1998:2000	374802,8	268029,6	284,42	313,40	97,8	98,6
1999:2001	392710,8	295052,3	277,81	315,54	95,5	99,3
2000:2002	408674,8	320098,9	278,46	316,78	95,8	99,7
2001:2003	421906,1	319086,5	288,93	346,30	99,4	109,0
2002:2004	430583,3	316819,4	317,24	400,86	109,1	126,2
2003:2005	457591,4	367158,7	352,28	432,24	121,1	136,0
2004:2006	485007,4	396598	358,96	429,40	123,4	135,2
2005:2007	500720,2	450972,2	358,68	356,12	123,3	112,1
2006:2008	549449,7	412431,3	308,67	370,73	106,1	116,7
Average			290,81	317,72		

Source: Danmarks Statistics and own calculations

Table 6 Price-to-disposable income ratio and affordability index, house and flat owner-occupiers, Denmark

	Disposable Income, DKK per household		Price- to-income		Affordability Index =(Price-Disposable Income/(Price-Disposable Income Average))*100	
	Owner-occupied detached house	Owner-occupied flat	Owner-occupied detached house	Owner-occupied flat	Owner-occupied detached house	Owner-occupied flat
1993:1995	250.613,10	205.964,50	274,13	235,48	80,0	58,5
1994:1996	267.992,90	208.832,90	295,90	251,40	86,4	62,5
1995:1997	278.629,00	204.017,80	295,37	268,11	86,2	66,6
1996:1998	296.997,30	209.937,10	302,02	311,52	88,2	77,4
1997:1999	318.443,40	212.847,30	303,98	341,09	88,7	84,8
1998:2000	325.385,50	219.530,40	327,61	382,63	95,6	95,1
1999:2001	339.027,30	215.227,60	321,80	432,57	93,9	107,5
2000:2002	340.227,70	246.018,20	334,48	412,16	97,6	102,5
2001:2003	344.858,00	245.824,80	353,48	449,51	103,2	111,7
2002:2004	354.717,10	282.101,20	385,10	450,19	112,4	111,9
2003:2005	395.607,40	305.746,50	407,47	519,06	118,9	129,0
2004:2006	421.662,60	340.733,40	412,89	499,80	120,5	124,2
2005:2007	429.766,30	334.233,90	417,90	480,50	122,0	119,4
2006:2008	465.313,50	255.768,70	364,49	597,81	106,4	148,6
Average			342,62	402,27		

Table 7: Quarterly data on gross national income, total mortgage credit lending and projected gross interest payments, DK

Frequency			here:not only housing purposes					
Name	DKK Gross National Income DKK Millions	Growth in national income, %	DK MORTGAGE CREDIT INSTITUTES - TOTAL LENDING, DKK Millions	growth in mortgage total lending, %	DK CENTRAL GOVT. BOND YIELD - 30 YR MORTAGE CREDIT , %	Gross Interest payments , DKK Millions	DK GROSS NATIONAL DISPOSABLE INCOME , DKK Millions	Mortgage Interest Payments as % of gross national disposable income, %
Q2 1993	221.739	-0,06	766.110	2,34	7,88	60.369	217.004	32
Q3 1993	225.042	1,48	777.296	1,45	7,34	57.054	220.271	28
Q4 1993	228.699	1,61	830.598	6,63	7,34	60.966	223.050	26
Q1 1994	234.592	2,54	865.914	4,16	7,41	64.164	229.617	27
Q2 1994	240.026	2,29	839.615	-3,08	8,59	72.123	235.096	28
Q3 1994	240.742	0,30	813.976	-3,10	9,27	75.456	234.795	31
Q4 1994	247.187	2,64	803.663	-1,28	9,49	76.268	242.258	32
Q1 1995	254.543	2,93	802.065	-0,20	9,91	79.485	249.828	31
Q2 1995	250.037	-1,79	800.757	-0,16	9,53	76.312	243.232	32
Q3 1995	248.920	-0,45	806.083	0,66	9,24	74.482	243.376	31
Q4 1995	255.139	2,47	852.599	5,61	8,71	74.261	250.727	31
Q1 1996	259.292	1,61	874.279	2,51	8,62	75.363	253.794	30
Q2 1996	263.494	1,61	865.505	-1,01	8,62	74.607	258.872	30
Q3 1996	262.759	-0,28	873.544	0,92	8,46	73.902	257.796	29
Q4 1996	270.286	2,82	894.106	2,33	7,99	71.439	262.592	29
Q1 1997	272.773	0,92	903.656	1,06	7,87	71.118	267.999	27
Q2 1997	278.074	1,92	926.198	2,46	7,75	71.780	273.382	27
Q3 1997	278.725	0,23	953.936	2,95	7,48	71.354	273.854	26
Q4 1997	280.135	0,50	966.826	1,34	7,41	71.642	275.929	26
Q1 1998	287.518	2,60	1.035.225	6,84	6,73	69.671	280.813	26
Q2 1998	284.321	-1,12	1.073.164	3,60	6,45	69.219	279.104	25
Q3 1998	290.321	2,09	1.076.583	0,32	6,41	69.009	286.357	25
Q4 1998	288.311	-0,69	1.060.461	-1,51	6,4	67.870	282.779	24
Q1 1999	294.908	2,26	1.118.908	5,36	6,35	71.051	288.993	24
Q2 1999	300.446	1,86	1.123.154	0,38	6,43	72.219	293.748	25
Q3 1999	300.426	-0,01	1.096.965	-2,36	7,22	79.201	291.783	25
Q4 1999	307.464	2,32	1.100.021	0,28	7,52	82.722	300.899	27
Q1 2000	310.176	0,88	1.113.312	1,20	7,4	82.385	303.587	27
Q2 2000	315.168	1,60	1.143.231	2,65	7,52	85.971	307.050	27
Q3 2000	315.402	0,07	1.143.059	-0,02	7,5	85.729	306.765	28
Q4 2000	325.861	3,26	1.151.446	0,73	7,34	84.516	316.672	28
Q1 2001	325.612	-0,08	1.162.609	0,96	7,2	83.708	321.117	27
Q2 2001	328.770	0,97	1.183.685	1,80	6,73	79.662	321.113	26
Q3 2001	329.753	0,30	1.204.789	1,77	6,5	78.311	322.013	25

Q4 2001	332.641	0,87	1.282.374	6,24	6,42	82.328	324.510	24
Q1 2002	332.204	-0,13	1.271.227	-0,87	6,56	83.392	327.013	25
Q2 2002	344.184	3,54	1.300.865	2,30	6,52	84.816	335.555	26
Q3 2002	339.483	-1,38	1.345.391	3,37	6,25	84.087	331.840	25
Q4 2002	340.650	0,34	1.366.371	1,55	5,79	79.113	332.318	25
Q1 2003	345.189	1,32	1.449.719	5,92	5,39	78.140	337.792	24
Q2 2003	344.791	-0,12	1.493.445	2,97	5,33	79.601	337.183	23
Q3 2003	347.370	0,75	1.478.484	-1,01	5,49	81.169	339.295	24
Q4 2003	354.770	2,11	1.501.811	1,57	5,55	83.351	347.169	24
Q1 2004	363.363	2,39	1.516.717	0,99	5,27	79.931	357.053	24
Q2 2004	366.028	0,73	1.550.946	2,23	5,44	84.371	356.064	22
Q3 2004	367.984	0,53	1.560.277	0,60	5,31	82.851	359.128	24
Q4 2004	375.543	2,03	1.590.195	1,90	5,14	81.736	366.699	23
Q1 2005	374.148	-0,37	1.682.461	5,64	4,46	75.038	365.300	22
Q2 2005	396.972	5,92	1.737.268	3,21	4,26	74.008	390.150	21
Q3 2005	393.964	-0,76	1.783.205	2,61	4,22	75.251	386.632	19
Q4 2005	401.723	1,95	1.776.727	-0,36	4,45	79.064	394.510	19
Q1 2006	403.894	0,54	1.879.131	5,60	4,59	86.252	394.853	20
Q2 2006	418.163	3,47	1.928.493	2,59	5,38	103.753	410.573	22
Q3 2006	422.983	1,15	1.989.523	3,12	5,27	104.848	414.848	25
Q4 2006	417.062	-1,41	2.093.850	5,11	5,22	109.299	408.121	25
Q1 2007	419.285	0,53	2.117.059	1,10	5,25	111.146	409.901	27
Q2 2007	427.298	1,89	2.184.873	3,15	5,48	119.731	418.653	27
Q3 2007	426.923	-0,09	2.273.215	3,96	5,56	126.391	417.759	29
Q4 2007	439.999	3,02	2.399.784	5,42	5,52	132.468	433.276	30
Q1 2008	433.776	-1,42	2.419.445	0,82	5,49	132.828	425.829	31
Q2 2008	448.715	3,39	2.485.373	2,69	5,9	146.637	440.946	31
Q3 2008	445.354	-0,75	2.541.715	2,24	6,51	165.466	437.491	33
Q4 2008	435.996	-2,12	2.624.011	3,19	6,43	168.724	427.613	38
Q1 2009	422.378	-3,17	2.604.411	-0,75	6,19	161.213	413.846	39
Q2 2009	417.312	-1,21	2.722.821	4,45	5,46	148.666	408.463	39
Q3 2009	420.043	0,65	2.749.174	0,96	5,22	143.507	411.819	36
Q4 2009	426.439	1,51	2.834.073	3,04	5,23	148.222	417.806	35
Q1 2010	433.982	1,75	2.836.569	0,09	5,05	143.247	424.960	35
Q2 2010	444.177	2,32	2.882.452	1,60	4,86	140.087	435.481	34
Q3 2010	445.161	0,22	2.964.482	2,81	4,34	128.659	436.294	32

Source: Danish Statistics, Danmarks Nationalbank and own calculations

Table 8: Quarterly data on gross national income, owner- occupier mortgage credit lending and projected gross interest payments, DK

Name	Housing prices-total, DKK Thousand	DK MORTGAGE CDT INSTITUTES: DOM LENDING-OWNER OCCUPIED DWELLINGS; DKK Million	DK CENTRAL GOVT. BOND YIELD - 30 YR MORTAGE CREDIT , %	Payments, DKK Million	DK GROSS NATIONAL DISPOSABLE INCOME, DKK Millions	DK GROSS NATIONAL INCOME, DKK Millions	DK NET NATIONAL DISPOSABLE INCOME , DKK Millions	DK GDP AT MARKET PRICES , DKK Millions
Q1 1993	683	395.525	9,27	36.665	217.349	222.263	180.845	223.661
Q2 1993	681	393.301	7,88	30.992	220.861	225.201	184.621	228.484
Q3 1993	608	401.285	7,34	29.454	216.740	221.327	180.784	223.587
Q4 1993	709	367.736	7,34	26.992	222.317	228.562	185.978	236.078
Q1 1994	701	377.802	7,41	27.995	229.896	234.769	192.592	234.263
Q2 1994	644	385.440	8,59	33.109	238.619	243.108	200.700	248.277
Q3 1994	664	386.433	9,27	35.822	231.195	237.000	193.009	238.821
Q4 1994	707	389.527	9,49	36.966	242.059	247.671	203.451	255.583
Q1 1995	679	389.623	9,91	38.612	248.793	253.331	209.455	250.216
Q2 1995	672	394.427	9,53	37.589	247.821	254.093	208.491	257.358
Q3 1995	649	397.555	9,24	36.734	241.049	246.536	201.736	248.672
Q4 1995	736	409.231	8,71	35.644	249.502	254.678	209.443	263.299
Q1 1996	731	415.448	8,62	35.812	252.200	257.177	211.397	256.387
Q2 1996	730	424.864	8,62	36.623	262.550	266.689	220.982	270.570
Q3 1996	730	436.687	8,46	36.944	256.338	261.187	214.456	264.947
Q4 1996	812	445.011	7,99	35.556	261.968	270.778	219.160	277.585
Q1 1997	772	450.984	7,87	35.492	265.052	268.908	221.334	268.970
Q2 1997	780	464.977	7,75	36.036	277.172	281.566	232.802	286.664
Q3 1997	778	478.856	7,48	35.818	271.660	276.576	227.445	276.699
Q4 1997	896	495.036	7,41	36.682	277.284	282.659	232.660	293.309
Q1 1998	875	507.354	6,73	34.145	277.592	282.636	232.227	283.033
Q2 1998	892	526.671	6,45	33.970	282.128	287.247	236.441	288.900
Q3 1998	849	539.909	6,41	34.608	284.067	288.350	238.211	288.247
Q4 1998	1046	552.946	6,4	35.389	285.272	292.239	237.718	303.436
Q1 1999	966	568.166	6,35	36.079	285.377	289.161	237.509	289.548
Q2 1999	948	580.854	6,43	37.349	295.950	302.707	246.729	303.056
Q3 1999	937	589.527	7,22	42.564	289.558	298.666	241.142	299.372
Q4 1999	1120	596.070	7,52	44.824	304.538	312.710	254.982	321.496
Q1 2000	1109	605.114	7,4	44.778	299.228	303.508	248.919	309.528
Q2 2000	1095	614.978	7,52	46.246	309.358	317.779	258.245	322.350
Q3 2000	1032	620.109	7,5	46.508	305.589	314.781	254.272	319.130
Q4 2000	1153	628.639	7,34	46.142	319.899	330.540	268.211	342.956
Q1 2001	1149	646.129	7,2	46.521	315.912	317.827	263.645	321.205
Q2 2001	1156	659.220	6,73	44.366	322.845	331.178	269.713	333.074
Q3 2001	1113	671.782	6,5	43.666	320.030	328.466	265.899	331.451

Q4 2001	1283	697.164	6,42	44.758	329.966	339.305	275.121	349.880
Q1 2002	1172	708.631	6,56	46.486	320.794	323.926	265.513	328.559
Q2 2002	1191	722.638	6,52	47.116	337.050	346.199	282.075	345.572
Q3 2002	1187	743.812	6,25	46.488	329.518	337.776	272.724	340.727
Q4 2002	1261	757.070	5,79	43.834	339.363	348.621	283.414	357.879
Q1 2003	1256	780.411	5,39	42.064	330.643	335.750	274.942	338.840
Q2 2003	1307	799.701	5,33	42.624	338.665	347.161	281.078	347.440
Q3 2003	1262	814.529	5,49	44.718	336.872	345.802	277.492	345.703
Q4 2003	1468	826.233	5,55	45.856	355.258	363.407	296.837	368.707
Q1 2004	1443	840.882	5,27	44.314	346.754	352.607	287.803	351.204
Q2 2004	1414	858.023	5,44	46.676	359.027	369.252	299.897	365.419
Q3 2004	1384	868.507	5,31	46.118	357.180	366.669	296.738	363.417
Q4 2004	1611	880.737	5,14	45.270	375.981	384.388	314.664	386.141
Q1 2005	1760	901.380	4,46	40.202	353.513	362.700	293.002	362.359
Q2 2005	1718	935.373	4,26	39.847	392.305	399.036	330.998	391.701
Q3 2005	1737	971.163	4,22	40.983	384.671	392.340	322.764	385.885
Q4 2005	1924	1.001.990	4,45	44.589	406.103	412.730	344.290	405.312
Q1 2006	2087	1.028.495	4,59	47.208	381.625	391.694	319.304	387.115
Q2 2006	2111	1.061.830	5,38	57.126	414.090	421.440	350.015	414.754
Q3 2006	2067	1.089.155	5,27	57.398	411.936	420.290	346.594	408.783
Q4 2006	2331	1.116.491	5,22	58.281	420.744	428.678	355.305	421.006
Q1 2007	2309	1.139.787	5,25	59.839	393.960	405.627	327.140	406.037
Q2 2007	2144	1.168.323	5,48	64.024	423.049	431.056	355.644	421.158
Q3 2007	2232	1.193.786	5,56	66.375	416.736	425.291	347.277	421.682
Q4 2007	2291	1.216.107	5,52	67.129	445.844	451.531	376.988	446.387
Q1 2008	2325	1.232.006	5,49	67.637	409.132	419.637	339.190	420.277
Q2 2008	2263	1.255.236	5,9	74.059	444.752	452.008	373.542	442.621
Q3 2008	1980	1.268.870	6,51	82.603	437.219	444.317	364.415	437.588
Q4 2008	2095	1.277.477	6,43	82.142	440.776	447.880	368.570	440.357
Q1 2009	2027	1.291.706	6,19	79.957	398.104	409.639	325.983	405.231
Q2 2009	1847	1.307.516	5,46	71.390	412.111	420.348	340.762	409.286
Q3 2009	1842	1.320.785	5,22	68.945	411.636	418.813	340.708	412.332
Q4 2009	1884	1.335.417	5,23	69.842	430.083	437.372	360.843	429.260
Q1 2010	1973	1.342.990	5,05	67.821	409.180	421.308	340.448	416.853
Q2 2010	1877	1.354.477	4,86	65.828	438.887	447.000	370.302	438.264
Q3 2010	1931	1.367.121	4,34	59.333	438.705	446.712	369.242	439.019

Source: Danmarks Nationalbank, Danmarks Statistics and own calculations

Table 9: Debt Burden and Interest Burden on owner-occupier mortgage lending, DK

	Owner-occupier mortgage lending as % of housing prices, %	Payments as % of gross national disposable income, %	Payments as % of gross national income, %	payments as % of GDP, %	Owner-occupier mortgage lending as % of GDP, %	Owner-occupier mortgage lending as % of gross national disposable income, %	Mortgage payments as % of total consumption ; %
Q1 1993	0,58	16,87	16,50	16,39	176,84	181,9769	32,91
Q2 1993	0,58	14,03	13,76	13,56	172,14	178,0763	27,38
Q3 1993	0,66	13,59	13,31	13,17	179,48	185,1458	26,10
Q4 1993	0,52	12,14	11,81	11,43	155,77	165,4107	21,75
Q1 1994	0,54	12,18	11,92	11,95	161,27	164,336	23,31
Q2 1994	0,60	13,88	13,62	13,34	155,25	161,5295	26,21
Q3 1994	0,58	15,49	15,11	15,00	161,81	167,1459	28,76
Q4 1994	0,55	15,27	14,93	14,46	152,41	160,9223	27,76
Q1 1995	0,57	15,52	15,24	15,43	155,71	156,6053	30,66
Q2 1995	0,59	15,17	14,79	14,61	153,26	159,158	28,68
Q3 1995	0,61	15,24	14,90	14,77	159,87	164,927	28,70
Q4 1995	0,56	14,29	14,00	13,54	155,42	164,0191	26,06
Q1 1996	0,57	14,20	13,92	13,97	162,04	164,7296	27,34
Q2 1996	0,58	13,95	13,73	13,54	157,03	161,8221	27,00
Q3 1996	0,60	14,41	14,14	13,94	164,82	170,3559	27,83
Q4 1996	0,55	13,57	13,13	12,81	160,32	169,8723	24,98
Q1 1997	0,58	13,39	13,20	13,20	167,67	170,1493	26,25
Q2 1997	0,60	13,00	12,80	12,57	162,20	167,7576	24,98
Q3 1997	0,62	13,19	12,95	12,94	173,06	176,2703	25,99
Q4 1997	0,55	13,23	12,98	12,51	168,78	178,5303	24,17
Q1 1998	0,58	12,30	12,08	12,06	179,26	182,7697	24,09
Q2 1998	0,59	12,04	11,83	11,76	182,30	186,678	23,12
Q3 1998	0,64	12,18	12,00	12,01	187,31	190,064	23,83
Q4 1998	0,53	12,41	12,11	11,66	182,23	193,8312	22,63
Q1 1999	0,59	12,64	12,48	12,46	196,23	199,0931	24,76
Q2 1999	0,61	12,62	12,34	12,32	191,67	196,2676	25,32
Q3 1999	0,63	14,70	14,25	14,22	196,92	203,5955	28,97
Q4 1999	0,53	14,72	14,33	13,94	185,41	195,7293	28,19
Q1 2000	0,55	14,96	14,75	14,47	195,50	202,2251	29,79
Q2 2000	0,56	14,95	14,55	14,35	190,78	198,7917	30,16
Q3 2000	0,60	15,22	14,77	14,57	194,31	202,9226	30,71
Q4 2000	0,55	14,42	13,96	13,45	183,30	196,5117	28,56
Q1 2001	0,56	14,73	14,64	14,48	201,16	204,5282	30,16
Q2 2001	0,57	13,74	13,40	13,32	197,92	204,1909	28,09
Q3 2001	0,60	13,64	13,29	13,17	202,68	209,9122	28,16

Q4 2001	0,54	13,56	13,19	12,79	199,26	211,2836	27,22
Q1 2002	0,60	14,49	14,35	14,15	215,68	220,8991	29,26
Q2 2002	0,61	13,98	13,61	13,63	209,11	214,4008	29,19
Q3 2002	0,63	14,11	13,76	13,64	218,30	225,7273	29,05
Q4 2002	0,60	12,92	12,57	12,25	211,54	223,0856	25,49
Q1 2003	0,62	12,72	12,53	12,41	230,32	236,0283	25,80
Q2 2003	0,61	12,59	12,28	12,27	230,17	236,1333	26,06
Q3 2003	0,65	13,27	12,93	12,94	235,62	241,7918	27,48
Q4 2003	0,56	12,91	12,62	12,44	224,09	232,5727	25,82
Q1 2004	0,58	12,78	12,57	12,62	239,43	242,501	26,12
Q2 2004	0,61	13,00	12,64	12,77	234,81	238,9856	26,93
Q3 2004	0,63	12,91	12,58	12,69	238,98	243,1567	26,64
Q4 2004	0,55	12,04	11,78	11,72	228,09	234,2504	23,69
Q1 2005	0,51	11,37	11,08	11,09	248,75	254,9779	22,64
Q2 2005	0,54	10,16	9,99	10,17	238,80	238,43	21,34
Q3 2005	0,56	10,65	10,45	10,62	251,67	252,4659	22,41
Q4 2005	0,52	10,98	10,80	11,00	247,21	246,733	22,53
Q1 2006	0,49	12,37	12,05	12,19	265,68	269,5041	24,74
Q2 2006	0,50	13,80	13,56	13,77	256,01	256,4249	28,75
Q3 2006	0,53	13,93	13,66	14,04	266,44	264,3991	30,13
Q4 2006	0,48	13,85	13,60	13,84	265,20	265,3611	28,21
Q1 2007	0,49	15,19	14,75	14,74	280,71	289,3154	30,20
Q2 2007	0,54	15,13	14,85	15,20	277,41	276,1673	31,37
Q3 2007	0,53	15,93	15,61	15,74	283,10	286,461	33,18
Q4 2007	0,53	15,06	14,87	15,04	272,43	272,7651	30,77
Q1 2008	0,53	16,53	16,12	16,09	293,14	301,1268	32,68
Q2 2008	0,55	16,65	16,38	16,73	283,59	282,2328	34,44
Q3 2008	0,64	18,89	18,59	18,88	289,97	290,2138	40,04
Q4 2008	0,61	18,64	18,34	18,65	290,10	289,8245	38,76
Q1 2009	0,64	20,08	19,52	19,73	318,76	324,4645	40,35
Q2 2009	0,71	17,32	16,98	17,44	319,46	317,2728	35,19
Q3 2009	0,72	16,75	16,46	16,72	320,32	320,8624	34,53
Q4 2009	0,71	16,24	15,97	16,27	311,10	310,5022	32,81
Q1 2010	0,68	16,57	16,10	16,27	322,17	328,215	32,45
Q2 2010	0,72	15,00	14,73	15,02	309,06	308,6163	31,28
Q3 2010	0,71	13,52	13,28	13,51	311,40	311,6265	28,34

Source: Danmarks Statistics, Danmarks Nationalbank and own calculations

Table 10: Gross and Net Financial margin and the underlying variables, DK

	DK GROSS NATIONAL DISPOSABLE, DKK Million	DK NET NATIONAL DISPOSABLE INCOME, DKK Million	Owner-occupiers gross interest payments, DKK Million	Housing-related consumption (excluding interest payments), DKK Million	Private final consumption expenditure, total, DKK Million	Private final consumption on food, DKK Million	Net Financil margin (NB)= Net national disposable income less housing-related consumption less housing consumption on food , DKK Million	DKK Net savings, DKK Million	DK property income from abroad, DKK Million	Gross Financial Margin (Finlay)= Gross national disposable income including savings and property income less all consumption less gross interest payments, DKK Million	Net Financial Margin Real Growht, %	Gross Financial Margin Real Growth, %
Q1 1993	216.940	180.845	36.665	32.872	111.401	12.506	135.467	11.090	25.515	72.768		
Q2 1993	217.004	184.621	30.992	35.814	113.213	13.763	135.044	11.414	31.398	86.234	0,09	9,17
Q3 1993	220.271	180.784	29.454	37.161	112.858	13.540	130.083	7.155	35.254	92.768	-3,98	4,03
Q4 1993	223.050	185.978	26.992	36.766	124.108	14.840	134.372	7.155	36.017	81.148	2,90	-4,46
Q1 1994	229.617	192.592	27.995	34.397	120.095	13.026	145.169	10.439	32.412	88.209	7,46	7,73
Q2 1994	235.096	200.700	33.109	38.999	126.332	14.292	147.409	12.075	34.522	83.238	1,34	-1,72
Q3 1994	234.795	193.009	35.822	40.895	124.559	14.533	137.581	6.443	32.940	74.163	-7,01	-7,17
Q4 1994	242.258	203.451	36.966	39.512	133.159	15.749	148.190	7.309	35.158	75.298	7,44	0,70
Q1 1995	249.828	209.455	38.612	35.855	125.955	13.446	160.154	20.178	26.683	91.249	7,51	14,23
Q2 1995	243.232	208.491	37.589	39.877	131.081	15.431	153.183	13.255	31.164	80.258	-4,39	-10,48
Q3 1995	243.376	201.736	36.734	41.170	127.979	15.360	145.206	9.206	30.366	80.487	-4,94	-0,63
Q4 1995	250.727	209.443	35.644	39.846	136.778	16.060	153.537	7.508	42.199	89.395	5,56	7,95
Q1 1996	253.794	211.397	35.812	37.112	131.002	13.702	160.583	14.278	35.569	97.276	4,54	6,66
Q2 1996	258.872	220.982	36.623	40.785	135.641	15.683	164.514	17.239	28.529	94.392	2,28	-3,31
Q3 1996	257.796	214.456	36.944	42.440	132.738	15.398	156.618	13.058	36.486	100.700	-5,21	3,91
Q4 1996	262.592	219.160	35.556	41.198	142.340	16.442	161.520	8.018	36.128	92.959	3,02	-6,62

Q1 1997	267.999	221.334	35.492	38.257	135.192	14.152	168.925	17.401	24.678	103.768	4,67	7,87
Q2 1997	273.382	232.802	36.036	43.672	144.236	15.789	173.341	18.205	25.037	100.608	2,64	-2,21
Q3 1997	273.854	227.445	35.818	45.452	137.813	15.621	166.372	18.773	18.845	102.305	-4,42	1,09
Q4 1997	275.929	232.660	36.682	45.001	151.786	17.081	170.578	9.807	30.706	93.014	2,76	-7,43
Q1 1998	280.813	232.227	34.145	41.459	141.724	14.484	176.284	18.046	23.905	111.369	3,37	13,79
Q2 1998	279.104	236.441	33.970	45.311	146.906	16.309	174.821	15.136	20.780	98.895	-0,75	-9,08
Q3 1998	286.357	238.211	34.608	47.884	145.259	15.884	174.443	17.741	17.781	107.611	0,07	5,70
Q4 1998	282.779	237.718	35.389	46.608	156.400	16.904	174.206	5.273	26.543	90.325	-0,17	-14,53
Q1 1999	288.993	237.509	36.079	42.566	145.704	14.715	180.228	16.150	15.760	104.148	3,09	12,47
Q2 1999	293.748	246.729	37.349	46.641	147.496	15.605	184.483	21.149	17.159	112.341	2,11	5,65
Q3 1999	291.783	241.142	42.564	49.465	146.929	15.773	175.904	15.894	15.644	97.191	-5,13	-9,53
Q4 1999	300.899	254.982	44.824	48.584	159.003	16.570	189.828	15.667	25.844	100.685	7,26	3,49
Q1 2000	303.587	248.919	44.778	45.658	150.334	14.844	188.417	19.799	28.197	118.864	-0,87	12,14
Q2 2000	307.050	258.245	46.246	49.165	153.338	16.550	192.530	24.128	29.590	121.459	2,06	2,97
Q3 2000	306.765	254.272	46.508	51.434	151.460	16.344	186.494	21.307	27.487	118.370	-2,71	-2,25
Q4 2000	316.672	268.211	46.142	50.589	161.550	17.001	200.621	22.632	38.223	131.461	7,43	7,48
Q1 2001	321.117	263.645	46.521	47.017	154.266	15.364	201.264	27.541	25.545	136.229	0,56	2,09
Q2 2001	321.113	269.713	44.366	50.277	157.922	17.261	202.175	26.470	28.438	138.437	0,25	0,18
Q3 2001	322.013	265.899	43.666	52.711	155.069	16.826	196.362	24.231	24.048	136.912	-2,75	-1,26
Q4 2001	324.510	275.121	44.758	51.352	164.430	17.827	205.942	21.186	30.475	129.413	5,08	-2,70
Q1 2002	327.013	265.513	46.486	48.425	158.846	15.896	201.192	20.096	23.470	128.341	-2,74	-1,05
Q2 2002	335.555	282.075	47.116	51.408	161.401	17.216	213.451	30.394	21.543	141.275	6,14	7,98
Q3 2002	331.840	272.724	46.488	53.284	160.037	17.531	201.909	21.871	19.468	129.055	-5,63	-7,13
Q4 2002	332.318	283.414	43.834	51.803	171.972	17.970	213.641	18.897	25.718	125.848	5,40	-3,37
Q1 2003	337.792	274.942	42.064	50.037	163.052	15.993	208.912	22.744	21.169	140.513	-2,43	9,16
Q2 2003	337.183	281.078	42.624	53.012	163.566	17.464	210.602	24.503	18.965	137.484	1,29	-1,21
Q3 2003	339.295	277.492	44.718	55.568	162.756	16.891	205.033	21.633	17.638	134.641	-2,24	-1,95
Q4 2003	347.169	296.837	45.856	55.229	177.568	19.178	222.430	23.290	22.426	131.966	8,53	-0,96
Q1 2004	357.053	287.803	44.314	53.155	169.662	16.353	218.295	23.869	20.644	151.973	-1,37	10,16
Q2 2004	356.064	299.897	46.676	56.474	173.329	18.139	225.284	28.966	20.324	147.654	3,00	-1,20
Q3 2004	359.128	296.738	46.118	59.201	173.137	17.500	220.037	26.543	19.244	148.927	-2,49	0,17

Q4 2004	366.699	314.664	45.270	58.430	191.086	19.865	236.369	23.482	24.250	141.609	6,98	-4,17
Q1 2005	365.300	293.002	40.202	54.615	177.569	16.925	221.462	18.053	33.943	164.689	-6,36	11,37
Q2 2005	390.150	330.998	39.847	60.728	186.752	18.590	251.680	43.779	31.974	205.143	12,35	18,18
Q3 2005	386.632	322.764	40.983	62.926	182.884	18.316	241.522	39.448	30.770	198.715	-4,64	-2,68
Q4 2005	394.510	344.290	44.589	61.559	197.934	19.363	263.368	42.125	31.070	190.707	8,79	-3,41
Q1 2006	394.853	319.304	47.208	56.993	190.787	17.261	245.050	26.068	30.889	174.771	-7,17	-5,18
Q2 2006	410.573	350.015	57.126	63.792	198.715	19.009	267.214	46.076	36.837	191.018	8,72	10,57
Q3 2006	414.848	346.594	57.398	66.131	190.486	18.654	261.809	50.565	31.256	201.335	-1,90	4,58
Q4 2006	408.121	355.305	58.281	64.623	206.594	20.354	270.328	39.321	34.657	166.206	3,36	-13,57
Q1 2007	409.901	327.140	59.839	60.578	198.126	18.182	248.380	22.201	39.398	162.228	-8,67	-1,71
Q2 2007	418.653	355.644	64.024	66.214	204.061	20.351	269.079	42.534	40.276	177.671	8,26	8,89
Q3 2007	417.759	347.277	66.375	67.601	200.029	19.944	259.732	37.836	39.295	168.470	-3,09	-2,12
Q4 2007	433.276	376.988	67.129	67.725	218.193	21.186	288.077	44.090	40.749	167.454	9,39	1,87
Q1 2008	425.829	339.190	67.637	64.275	206.998	19.529	255.386	21.360	39.930	147.293	-12,89	-9,13
Q2 2008	440.946	373.542	74.059	71.166	215.043	21.719	280.657	43.536	38.248	161.050	8,98	9,49
Q3 2008	437.491	364.415	82.603	72.156	206.328	20.787	271.472	41.145	36.083	142.925	-3,95	-3,41
Q4 2008	427.613	368.570	82.142	66.999	211.921	21.783	279.788	34.613	33.802	115.383	4,21	-11,15
Q1 2009	413.846	325.983	79.957	63.439	198.155	18.761	243.783	8.511	29.258	92.247	-12,71	-15,19
Q2 2009	408.463	340.762	71.390	68.286	202.855	20.727	251.749	14.660	23.069	94.671	3,77	-0,90
Q3 2009	411.819	340.708	68.945	71.509	199.681	19.842	249.357	16.498	20.945	106.074	-0,67	4,93
Q4 2009	417.806	360.843	69.842	68.402	212.893	20.928	271.513	18.740	21.278	96.709	8,26	-3,12
Q1 2010	424.960	340.519	67.821	65.121	208.988	19.200	256.198	6.020	28.208	106.953	-6,60	4,08
Q2 2010	435.481	370.653	65.828	70.862	210.429	20.494	279.297	29.590	24.452	139.007	8,57	15,65
Q3 2010	436.294	366.368	59.333	74.417	209.385		291.951	32.875	24.123	155.248	-2,85	5,17

Source: Danmarks Nationalnbank, Danmarks Statistics and own calculations

Table 11 Mortgage loans developments by type, Denmark

DKK billion	1993M01	1994M01	1995M01	1996M01	1997M01	1998M01	1999M01	2000M01	2001M01	2002M01	2003M01	2004M01	2005M01	2006M01	2007M01	2007M08
Total	789	761,1	764,4	801,2	842,8	913,8	994,8	1047,3	1102,9	1194,3	1296,1	1402,1	1497,3	1675,3	1846,1	1951,6
I. Fixed-rate loans	698,4	667,3	667,3	701,4	741,1	805,5	853,5	870	886,3	818,7	817,2	785,4	724,8	763	887,5	1018,2
II. Adjustable-rate loans	..	..	..	..	..	..	25,3	63,6	103,8	266,5	374,9	516,9	677,8	823,5	874,9	851,8
1. 1 year or less	..	..	..	..	..	..	18,5	46,7	82	149,3	214,6	290,3	424,7	615	646	615,3
2. More than 1 year	..	..	..	..	..	..	6,8	16,9	21,8	117,2	160,3	226,6	253,1	208,5	228,8	236,5
III. Index-linked loans	90,6	93,8	97,1	99,8	101,7	108,3	116	113,7	112,8	109	104	99,8	94,8	88,8	83,7	81,6
Growth		**1994M01**	**1995M01**	**1996M01**	**1997M01**	**1998M01**	**1999M01**	**2000M01**	**2001M01**	**2002M01**	**2003M01**	**2004M01**	**2005M01**	**2006M01**	**2007M01**	**2007M08**
Total		-3,54	0,43	4,81	5,19	8,42	8,86	5,28	5,31	8,29	8,52	8,18	6,79	11,89	10,20	5,71
I. Fixed-rate loans		-4,45	0,00	5,11	5,66	8,69	5,96	1,93	1,87	-7,63	-0,18	-3,89	-7,72	5,27	16,32	14,73
II. Adjustable-rate loans		n/a	n/a	n/a	n/a	n/a	n/a	151,38	63,21	156,74	40,68	37,88	31,13	21,50	6,24	-2,64
1. 1 year or less		n/a	n/a	n/a	n/a	n/a	n/a	152,43	75,59	82,07	43,74	35,27	46,30	44,81	5,04	-4,75
2. More than 1 year		n/a	n/a	n/a	n/a	n/a	n/a	148,53	28,99	437,61	36,77	41,36	11,69	-17,62	9,74	3,37
III. Index-linked loans		3,53	3,52	2,78	1,90	6,49	7,11	-1,98	-0,79	-3,37	-4,59	-4,04	-5,01	-6,33	-5,74	-2,51
Share of total mortgage lending	**1993M01**	**1994M01**	**1995M01**	**1996M01**	**1997M01**	**1998M01**	**1999M01**	**2000M01**	**2001M01**	**2002M01**	**2003M01**	**2004M01**	**2005M01**	**2006M01**	**2007M01**	**2007M08**
Total	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00
I. Fixed-rate loans	88,52	87,68	87,30	87,54	87,93	88,15	85,80	83,07	80,36	68,55	63,05	56,02	48,41	45,54	48,07	52,17
II. Adjustable-rate loans	0,00	0,00	0,00	0,00	0,00	0,00	2,54	6,07	9,41	22,31	28,93	36,87	45,27	49,16	47,39	43,65
1. 1 year or less	0,00	0,00	0,00	0,00	0,00	0,00	1,86	4,46	7,43	12,50	16,56	20,70	28,36	36,71	34,99	31,53
2. More than 1 year	0,00	0,00	0,00	0,00	0,00	0,00	0,68	1,61	1,98	9,81	12,37	16,16	16,90	12,45	12,39	12,12
III. Index-linked loans	11,48	12,32	12,70	12,46	12,07	11,85	11,66	10,86	10,23	9,13	8,02	7,12	6,33	5,30	4,53	4,18

Source: Danmarks Statistics

Table 12: Housing Affordability Calculations, Denmark

				Quarterly first- year payments											
Name	Average prices of a dwelling, DKK	Outstanding Loan (80% of house price), DKK	DK CENTRAL GOVT. BOND YIELD - 30 YR MORTAGE CREDIT , %	Interest payments (Outstanding loan*bond yield), DKK	property taxes (2% of a house price per year), DKK	Insurance (0,38% of a house price per year)	Installments (based on 30- year loan), DKK	Payments- Total cost (interest payments+propery taxes+insurance+installments, DKK	Housing related cost (1 % of a housing price per year), DKK	Tax shield	Minimum disposable income (130% of payments), DKK	Min Disposable income including housing related cost and excluding tax shield, DKK	Actual net disposable income (aggregate level), DKK Million	Income per household, DKK	The Difference between min. required income and the actual income, DKK
Q1 1992	636.000	508.800	9,8	12.415	3.180	6.042	5.300	26.937	1.590	0,50	89.789,1	85.171,7	181.541,0	72.848,7	-12.323,0
Q2 1992	610.000	488.000	9,9	12.115	3.050	5.795	5.083	26.043	1.525	0,50	86.809,8	82.277,5	183.460,0	73.618,8	-8.658,7
Q3 1992	594.000	475.200	10,5	12.522	2.970	5.643	4.950	26.085	1.485	0,50	86.948,4	82.172,6	181.345,0	72.770,1	-9.402,6
Q4 1992	650.000	520.000	10,2	13.247	3.250	6.175	5.417	28.089	1.625	0,50	93.628,9	88.630,4	182.794,0	73.351,5	-15.278,8
Q1 1993	683.000	546.400	9,3	12.663	3.415	6.489	5.692	28.258	2.630	0,50	94.193,3	90.491,4	180.845,0	72.569,4	-17.922,0
Q2 1993	681.000	544.800	7,9	10.733	3.405	6.470	5.675	26.282	2.622	0,50	87.606,9	84.862,4	184.621,0	74.084,7	-10.777,8
Q3 1993	608.000	486.400	7,3	8.925	3.040	5.776	5.067	22.808	2.341	0,50	76.027,0	73.905,1	180.784,0	72.545,0	-1.360,1
Q4 1993	709.000	567.200	7,3	10.408	3.545	6.736	5.908	26.597	2.730	0,50	88.656,5	86.182,1	185.978,0	74.629,2	-11.552,9
Q1 1994	701.000	560.800	7,4	10.389	3.505	6.660	5.842	26.395	2.699	0,50	87.983,3	85.487,7	192.592,0	77.283,3	-8.204,4
Q2 1994	644.000	515.200	8,6	11.064	3.220	6.118	5.367	25.769	2.479	0,50	85.895,3	82.842,7	200.700,0	80.536,9	-2.305,9
Q3 1994	664.000	531.200	9,3	12.311	3.320	6.308	5.533	27.472	2.556	0,50	91.573,0	87.974,1	193.009,0	77.450,6	-10.523,5
Q4 1994	707.000	565.600	9,5	13.419	3.535	6.717	5.892	29.562	2.722	0,50	98.540,1	94.552,6	203.451,0	81.640,8	-12.911,8
Q1 1995	679.000	543.200	9,9	13.458	3.395	6.451	5.658	28.962	2.614	0,50	96.538,7	92.424,0	209.455,0	84.050,1	-8.373,9
Q2 1995	672.000	537.600	9,5	12.808	3.360	6.384	5.600	28.152	2.587	0,50	93.841,1	90.024,1	208.491,0	83.663,2	-6.360,9
Q3 1995	649.000	519.200	9,2	11.994	3.245	6.166	5.408	26.812	2.499	0,46	89.374,5	85.396,7	201.736,0	80.952,6	-4.444,1
Q4 1995	736.000	588.800	8,7	12.821	3.680	6.992	6.133	29.626	2.834	0,46	98.754,8	94.665,0	209.443,0	84.045,2	-10.619,8
Q1 1996	731.000	584.800	8,6	12.602	3.655	6.945	6.092	29.294	2.814	0,46	97.645,4	93.654,4	211.397,0	84.829,3	-8.825,0
Q2 1996	730.000	584.000	8,6	12.585	3.650	6.935	6.083	29.254	2.811	0,46	97.511,8	93.526,3	220.982,0	88.675,6	-4.850,7
Q3 1996	730.000	584.000	8,5	12.352	3.650	6.935	6.083	29.020	2.811	0,46	96.733,1	92.873,7	214.456,0	86.056,9	-6.816,9
Q4 1996	812.000	649.600	8,0	12.976	4.060	7.714	6.767	31.516	3.126	0,46	105.054,8	101.174,0	219.160,0	87.944,5	-13.229,6
Q1 1997	772.000	617.600	7,9	12.151	3.860	7.334	6.433	29.779	2.972	0,46	99.262,0	95.672,6	221.334,0	88.816,9	-6.855,7
Q2 1997	780.000	624.000	7,8	12.090	3.900	7.410	6.500	29.900	3.003	0,46	99.666,7	96.141,1	232.802,0	93.418,7	-2.722,3
Q3 1997	778.000	622.400	7,5	11.639	3.890	7.391	6.483	29.403	2.995	0,46	98.010,7	94.721,0	227.445,0	91.269,1	-3.451,9
Q4 1997	896.000	716.800	7,4	13.279	4.480	8.512	7.467	33.737	3.450	0,46	112.458,0	108.737,0	232.660,0	93.361,8	-15.375,3
Q1 1998	875.000	700.000	6,7	11.778	4.375	8.313	7.292	31.757	3.369	0,46	105.855,6	102.864,5	232.227,0	93.188,0	-9.676,4

Q2 1998	892.000	713.600	6,5	11.507	4.460	8.474	7.433	31.874	3.434	0,46	106.247,1	103.467,6	236.441,0	94.879,0	-8.588,6
Q3 1998	849.000	679.200	6,4	10.884	4.245	8.066	7.075	30.270	3.269	0,46	100.898,9	98.290,1	238.211,0	95.589,3	-2.700,9
Q4 1998	1.046.000	836.800	6,4	13.389	5.230	9.937	8.717	37.272	4.027	0,46	124.241,6	121.038,7	237.718,0	95.391,4	-25.647,3
Q1 1999	966.000	772.800	6,4	12.268	4.830	9.177	8.050	34.325	3.719	0,46	114.417,3	111.511,6	237.509,0	95.307,6	-16.204,0
Q2 1999	948.000	758.400	6,4	12.191	4.740	9.006	7.900	33.837	3.650	0,46	112.790,9	109.857,4	246.729,0	99.007,4	-10.850,1
Q3 1999	937.000	749.600	7,2	13.530	4.685	8.902	7.808	34.925	3.607	0,46	116.417,0	112.718,1	241.142,0	96.765,4	-15.952,7
Q4 1999	1.120.000	896.000	7,5	16.845	5.600	10.640	9.333	42.418	4.312	0,46	141.393,8	136.609,6	254.982,0	102.319,1	-34.290,5
Q1 2000	1.109.000	887.200	7,4	16.413	5.545	10.536	9.242	41.735	4.270	0,32	139.117,9	132.226,6	248.919,0	99.886,2	-32.340,4
Q2 2000	1.095.000	876.000	7,5	16.469	5.475	10.403	9.125	41.471	4.216	0,32	138.237,7	131.254,6	258.245,0	103.628,5	-27.626,1
Q3 2000	1.032.000	825.600	7,5	15.480	5.160	9.804	8.600	39.044	3.973	0,32	130.146,7	123.593,5	254.272,0	102.034,2	-21.559,2
Q4 2000	1.153.000	922.400	7,3	16.926	5.765	10.954	9.608	43.253	4.439	0,32	144.176,2	137.105,6	268.211,0	107.627,7	-29.477,9
Q1 2001	1.149.000	919.200	7,2	16.546	5.745	10.916	9.575	42.781	4.424	0,32	142.603,7	135.776,3	263.645,0	105.795,4	-29.980,9
Q2 2001	1.156.000	924.800	6,7	15.560	5.780	10.982	9.633	41.955	4.451	0,32	139.850,3	133.720,3	269.713,0	108.230,4	-25.489,9
Q3 2001	1.113.000	890.400	6,5	14.469	5.565	10.574	9.275	39.883	4.285	0,32	132.941,7	127.387,8	265.899,0	106.699,9	-20.687,9
Q4 2001	1.283.000	1.026.400	6,4	16.474	6.415	12.189	10.692	45.769	4.940	0,32	152.563,0	146.300,4	275.121,0	110.400,5	-35.899,9
Q1 2002	1.172.000	937.600	6,6	15.377	5.860	11.134	9.767	42.137	4.512	0,33	140.457,7	134.667,5	265.513,0	106.545,0	-28.122,5
Q2 2002	1.191.000	952.800	6,5	15.531	5.955	11.315	9.925	42.725	4.585	0,33	142.417,1	136.597,0	282.075,0	113.191,0	-23.406,0
Q3 2002	1.187.000	949.600	6,3	14.838	5.935	11.277	9.892	41.941	4.570	0,33	139.802,2	134.431,0	272.724,0	109.438,6	-24.992,4
Q4 2002	1.261.000	1.008.800	5,8	14.602	6.305	11.980	10.508	43.395	4.855	0,33	144.650,7	139.722,0	283.414,0	113.728,3	-25.993,6
Q1 2003	1.256.000	1.004.800	5,4	13.540	6.280	11.932	10.467	42.218	4.836	0,33	140.727,8	136.491,8	274.942,0	110.328,7	-26.163,2
Q2 2003	1.307.000	1.045.600	5,3	13.933	6.535	12.417	10.892	43.776	5.032	0,33	145.919,3	141.616,4	281.078,0	112.790,9	-28.825,5
Q3 2003	1.262.000	1.009.600	5,5	13.857	6.310	11.989	10.517	42.672	4.859	0,33	142.241,4	137.816,1	277.492,0	111.351,9	-26.464,2
Q4 2003	1.468.000	1.174.400	5,6	16.295	7.340	13.946	12.233	49.814	5.652	0,33	166.047,1	160.781,4	296.837,0	119.114,7	-41.666,7
Q1 2004	1.443.000	1.154.400	5,3	15.209	7.215	13.709	12.025	48.158	5.556	0,33	160.525,7	155.891,1	287.803,0	115.489,5	-40.401,6
Q2 2004	1.414.000	1.131.200	5,4	15.384	7.070	13.433	11.783	47.671	5.444	0,33	158.902,2	154.038,6	299.897,0	120.342,6	-33.696,0
Q3 2004	1.384.000	1.107.200	5,3	14.698	6.920	13.148	11.533	46.299	5.328	0,33	154.331,4	149.812,1	296.738,0	119.075,0	-30.737,1
Q4 2004	1.611.000	1.288.800	5,1	16.561	8.055	15.305	13.425	53.346	6.202	0,33	177.818,6	172.925,0	314.664,0	126.268,3	-46.656,7
Q1 2005	1.760.000	1.408.000	4,5	15.699	8.800	16.720	14.667	55.886	6.776	0,33	186.286,2	182.543,8	293.002,0	117.575,8	-64.968,0
Q2 2005	1.718.000	1.374.400	4,3	14.637	8.590	16.321	14.317	53.865	6.614	0,33	179.550,1	176.357,4	330.998,0	132.822,8	-43.534,5
Q3 2005	1.737.000	1.389.600	4,2	14.660	8.685	16.502	14.475	54.322	6.687	0,33	181.072,6	177.937,7	322.764,0	129.518,7	-48.419,0
Q4 2005	1.924.000	1.539.200	4,5	17.124	9.620	18.278	16.033	61.055	7.407	0,33	203.516,4	199.451,0	344.290,0	138.156,6	-61.294,4
Q1 2006	2.087.000	1.669.600	4,6	19.159	10.435	19.827	17.392	66.812	8.035	0,33	222.706,1	217.904,7	319.304,0	128.130,3	-89.774,5
Q2 2006	2.111.000	1.688.800	5,4	22.714	10.555	20.055	17.592	70.916	8.127	0,33	236.385,1	229.293,8	350.015,0	140.454,0	-88.839,9

Q3 2006	2.067.000	1.653.600	5,3	21.786	10.335	19.637	17.225	68.983	7.958	0,33	229.942,3	223.303,5	346.594,0	139.081,2	-84.222,3
Q4 2006	2.331.000	1.864.800	5,2	24.336	11.655	22.145	19.425	77.560	8.974	0,33	258.533,8	251.203,3	355.305,0	142.576,7	-108.626,5
Q1 2007	2.309.000	1.847.200	5,3	24.245	11.545	21.936	19.242	76.967	8.890	0,33	256.555,6	249.201,4	327.140,0	131.274,7	-117.926,7
Q2 2007	2.144.000	1.715.200	5,5	23.498	10.720	20.368	17.867	72.453	8.254	0,33	241.509,7	234.020,3	355.644,0	142.712,8	-91.307,5
Q3 2007	2.232.000	1.785.600	5,6	24.820	11.160	21.204	18.600	75.784	8.593	0,33	252.612,8	244.576,7	347.277,0	139.355,3	-105.221,5
Q4 2007	2.291.000	1.832.800	5,5	25.293	11.455	21.765	19.092	77.604	8.820	0,33	258.679,4	250.553,6	376.988,0	151.277,7	-99.276,0
Q1 2008	2.325.000	1.860.000	5,5	25.529	11.625	22.088	19.375	78.616	8.951	0,33	262.053,3	253.900,5	339.190,0	136.110,1	-117.790,4
Q2 2008	2.263.000	1.810.400	5,9	26.703	11.315	21.499	18.858	78.375	8.713	0,33	261.250,8	252.072,0	373.542,0	149.894,9	-102.177,2
Q3 2008	1.980.000	1.584.000	6,5	25.780	9.900	18.810	16.500	70.990	7.623	0,33	236.632,0	226.982,7	364.415,0	146.232,4	-80.750,3
Q4 2008	2.095.000	1.676.000	6,4	26.942	10.475	19.903	17.458	74.778	8.066	0,33	249.258,4	239.273,3	368.570,0	147.899,7	-91.373,6
Q1 2009	2.027.000	1.621.600	6,2	25.094	10.135	19.257	16.892	71.377	7.804	0,33	237.924,8	228.915,6	325.983,0	130.810,4	-98.105,2
Q2 2009	1.847.000	1.477.600	5,5	20.169	9.235	17.547	15.392	62.342	7.111	0,33	207.808,0	201.405,6	340.762,0	136.740,9	-64.664,7
Q3 2009	1.842.000	1.473.600	5,2	19.230	9.210	17.499	15.350	61.289	7.092	0,33	204.298,3	198.505,5	340.708,0	136.719,2	-61.786,3
Q4 2009	1.884.000	1.507.200	5,2	19.707	9.420	17.898	15.700	62.725	7.253	0,33	209.082,1	203.132,1	360.843,0	144.799,0	-58.333,1
Q1 2010	1.973.000	1.578.400	5,1	19.927	9.865	18.744	16.442	64.977	7.596	0,33	216.591,6	210.836,3	340.519,0	136.643,4	-74.192,9
Q2 2010	1.877.000	1.501.600	4,9	18.244	9.385	17.832	15.642	61.103	7.226	0,33	203.675,4	198.678,0	370.653,0	148.735,6	-49.942,5
Q3 2010	1.931.000	1.544.800	4,3	16.761	9.655	18.345	16.092	60.852	7.434	0,33	202.840,8	199.045,2	366.368,0	147.016,1	-52.029,2
Q4 2010	1.893.000	1.514.400	4,4	16.658	9.465	17.984	15.775	59.882	7.288	0,33	199.606,3	195.733,3	388.442,0	155.873,9	-39.859,3

Source: own creation