ANO 2004/21

Oslo
November 11, 2004

Working Paper

Research Department

House prices in Norway 1819–1989

by

Øyvind Eitrheim and Solveig K. Erlandsen

NORGES BANK

Working papers fra Norges Bank kan bestilles over e-post:
posten@norges-bank.no
eller ved henvendelse til:
Norges Bank, Abonnementsservice
Postboks 1179 Sentrum
0107 Oslo
Telefon 22 31 63 83, Telefaks 22 41 31 05

Fra 1999 og senere er publikasjonene tilgjengelige som pdf-filer
på www.norges-bank.no, under "Publikasjoner".

Working papers inneholder forskningsarbeider
og utredninger som vanligvis
ikke har fått sin endelige form.
Hensikten er blant annet at forfatteren
kan motta kommentarer fra kolleger
og andre interesserte.

Synspunkter og konklusjoner i arbeidene
står for forfatternes regning.

Working papers from Norges Bank can be ordered by e-mail:
posten@norges-bank.no
or from Norges Bank, Subscription service,
P.O.Box. 1179 Sentrum
N-0107Oslo, Norway.
Tel. +47 22 31 63 83, Fax. +47 22 41 31 05

Working papers from 1999 onwards are available as pdf-files on the bank's
web site: www.norges-bank.no, under "Publications".

Norges Bank's working papers present
research projects and reports
(not usually in their final form)
and are intended inter alia to enable
the author to benefit from the comments
of colleagues and other interested parties.

Views and conclusions expressed in working papers are
the responsibility of the authors alone.

ISSN 0801-2504 (printed) 1502-8143 (online)

ISBN 82-7553-281-7 (printed), 82-7553-282-5 (online)

House prices in Norway 1819–1989

Øyvind Eitrheim and Solveig K. Erlandsen*

11th November 2004

Abstract

Annual house price indices for four Norwegian cities are presented for the period from 1819 to 1989. The indices are constructed on the basis of nominal housing transaction prices compiled from the real property registers of the cities. Existing Norwegian house prices indices generally cover a few decades and usually start in the mid-1980s. Hence, we present new information about Norwegian house prices for more than 160 years. The house price indices seem to fit well in with historical events and available indicators of the Norwegian economy. The overall trend in nominal house prices is upward sloping over the two centuries. However, in real terms the picture looks different, in particular in the first half of the twentieth century.

Keywords: *Economic history, house prices, repeat sales indices*

JEL classifications: N10, E31, C81

*The first author is director of the research department in Norges Bank and the second author is a research officer in the same department.
The raw data used in this study are compiled from real estate archives by the students Merethe Nødtvedt, Cecilie Ramm, Øyvind Rykke, Kristian Råen, Kristin Skjelbred, Tone Østreim, and cand. philol. Svein Henrik Pedersen. Comments from Peter Englund, Ola H. Grytten, Lars Gulbrandsen, Jan Tore Klovland, Espen Moen, Jan F. Qvigstad, and participants at two workshops in Norges Bank and a seminar arranged by "Boligøkonomisk nettverk" are gratefully acknowledged. The views expressed are those of the authors and should not be interpreted as reflecting those of Norges Bank. Please address correspondence to: Øyvind Eitrheim, Research Department, C-51, Norges Bank (the Central Bank of Norway), Box 1179 Sentrum, N-0107 Oslo, Norway. Phone: +4722316161, Fax: +4722424062, Email: oyvind.eitrheim@norges-bank.no

1 Introduction

Existing house price indices for Norway typically cover a short time span of a few decades or so. Statistics Norway has published house price indices for new single-family houses since 1989 and a broadly defined house price index exists since 1991. Furthermore, the Norwegian Association of Real Estate Agents (NEF) has compiled and published regional and nationwide house price indices back to 1985. Besides this, some Norwegian house price indices are available which cover either a limited time period or a particular region or both. An example of such an index is provided in Hanisch and Ryggvik (1993). They constructed a house price index for apartment blocks in Oslo for the period 1890-1899. Another example is the price index for a particular area of Oslo for the period 1956-1976, published in NOU (1981). Also in an international perspective long runs of house price indices are rare. Generally, house price indices are constructed only for the last decades, and few house price indices are available for the period before World War II. However, a few exceptions are noted. One is Eichholtz (1997), who constructed a biennial house price index for an area of Amsterdam for the period 1628-1973. Another is Friggit (2001), who constructed an annual house price index for Paris for the period 1840-1999.

In this chapter we present annual house price indices for Norway from 1819 to 1989. More specifically, we construct a historical house price index for the inner cities of each of the four cities in our sample - Oslo, Bergen Trondheim and Kristiansand - in addition to an aggregate index. Due to data availability, the five indices start in different years at the 19th century. The house price indices are constructed on the basis of nominal transaction prices of real property, compiled from archives of real property registers of the four cities. To obtain house price indices in real terms, the nominal house price indices are deflated by the consumer price index (CPI).[1]

The remainder of this chapter is organized as follows. In Section 2 we provide a brief description of housing in the four cities in our sample. Data are described in Section 3, while the empirical approach used for constructing the indices is outlined in Section 4.

[1] The CPI is taken from Grytten (2004).

The house price indices are presented in Section 5, and Section 6 concludes.

2 Background

The cities in our sample comprise four of the five largest in Norway, and the cities inhabit currently more than one fifth of the population, cf. Table 1 which shows the population development in Norway and each of the four cities since 1815. In the following we give a brief description of some main characteristics of the housing developments in the four cities. A historical overview of the Norwegian housing market regulations is provided at the end of the section.

Table 1: Population(in thousands), 1815-2000*

	Norway	Oslo	Bergen	Trondheim	Kristiansand
1815	885	11	16	10	7
1845	1 328	26	22	15	8
1890	2 001	151	54	25	13
1930	2 814	253	98	54	19
1960	3 591	476	116	59	28
2000	4 503	507	229	149	72

*Note that the city boundaries have been enlarged several times over this period.
Sources: Statistics Norway, Bratberg and Arntzen (1996), Tvedt (2000) Hagen Hartvedt (1994) and www.kristiansand.kommune.no.

2.1 Oslo[2]

Oslo is the capital of Norway, located south-east in the country. The city is by far Norway's largest, with more than 10 percent of the country's inhabitants currently living in it. Although the city was founded a millennium ago, the modern Oslo originates from 1624, as a fire had destroyed the old city.[3] The new city was built in brick. Both the construction of buildings and the population evolved slowly over the first centuries. It was not until the second half of the 19th century that both the population and the activity

[2]This section is in large based on Tvedt (2000).

[3]The city was both moved and renamed to Christiania/Kristiania in 1624, a name it retained until 1925.

in the construction sector increased sharply. The construction sector was in particular booming in the 1880s and 1890s, when a large part of Oslo's current inner city residential buildings were built. Typically, the buildings were four-, and five-story brick apartment blocks, built for rental.[4] The city boundary has been enlarged several times over the last centuries. With the enlargements in 1859 and 1878 many wooden residential buildings were included in the city's housing stock. The biggest enlargement took place in 1948, when the Aker region was incorporated in the city. After World War II and up to the 1980s construction of residential buildings in Oslo took mainly place in the new suburbs in the previous Aker region.

Oslo's population has increased from 11 000 in 1815 to more than half a million today, cf. Table 1. Except for some few periods the population growth has been continuous over the period. An exception is the period from 1900 to 1905 when the population declined with more than two percent.[5] Another is the period from 1969 to 1984. During this period the population declined from 488 000 to 447 000 inhabitants. At the same time a large internal relocation of Oslo's population took place, as many people moved from the inner city to the new suburbs in the previous Aker region.[6]

2.2 Bergen[7]

Bergen is Norway's second largest city, situated on the west coast of the country. The city was for centuries the country's leading commercial marketplace, and until the beginning of the 19th century it was the most populated, cf. Table 1. Through the centuries Bergen has been haunted by many fires. The 1702 fire was in particular devastating, in which almost 90 percent of the city's buildings burnt down. However, as the houses mainly were rebuilt as small wooden houses, and the narrow streets and alleys were retained, the fire did not change the city's character substantially. A new housing type were introduced in the city

[4] At the turn of the century around 95 percent of Oslo's households were tenants, cf. e.g. Gulbrandsen (1980).

[5] Source: Hanisch and Ryggvik (1993).

[6] While 70 percent of the city's population lived in the inner city, defined as Oslo before the 1948-enlargement, in 1949, this share was reduced to 29 percent in 1988.

[7] This section is in large based on Hagen Hartvedt (1994).

after the 1855 fire, when brick apartment blocks were constructed in an inner city area. In the last decades of the 19th century the activity in the construction sector was high also in Bergen. Typically, the new buildings in the inner city were brick apartment blocks of several floors, while two-story wooden dwellings were constructed on its' outskirts. Many buildings in the inner city were destroyed by the 1916 fire. Similar to Oslo, housing construction in the post-WWII period took mainly place in suburbs outside the city centre.

The population of Bergen has ten-folded from 1815 to 2000, and it is currently above 230 000. A large share of the population growth is due to enlargements of the city boundary. The 1972-enlargement alone increased the number of inhabitants in Bergen from 111 000 to 212 000. In the 1970s population growth levelled out in Bergen, and the number of inhabitants in the inner city area declined.

2.3 Trondheim[8]

Trondheim is Norway's third largest city, situated in the middle of the country. The city was founded for more than 1000 years ago. Also Trondheim has been haunted by many fires over the centuries, and from the mid-19th century new buildings in the city had to be built in brick. At the end of the 19th century and the beginning of the 20th century many three-, and four-story brick apartment blocks, built for rental, were constructed in the city. However, old wooden houses, of one- to three-story, still dominate many inner city areas. The city boundary was extended three times during the 19th century, and in 1952 and 1964. In the decades after WWII construction of new residential buildings took mainly place in these new parts of Trondheim.

The population of Trondheim has grown almost continuously over the centuries and it inhabits currently around 150 000 people. In the period 1946-1970 the annual average population growth was at 1.5 percent. Similar to Oslo and Bergen, the growth rate declined in the 1970s before it levelled out in the 1980s. At the end of the 1980s the

[8]This section is in large based on Bratberg and Arntzen (1996).

number of inhabitants started to increase again.

2.4 Kristiansand[9]

Kristiansand is the fifth largest town in Norway, located at the south coast of the country. The city was founded in 1641, and it is characterized by its quadratic inner city called "Kvadraturen". The houses in the inner city were originally built in wood. However, after the conflagration in July 1892, the houses in the burnt-down area were obliged to be rebuilt in brick. One-, and two-story houses dominated housing in the city, also after the 1892 fire. The activity in the residential construction sector was huge, both in the inner city and on its' outskirts, in the first decades after WWII. In this period many wooden houses in "Kvadraturen" were demolished and replaced by four-, and five-story apartment blocks.

The population of Kristiansand has increased from around 7 000 at the beginning of the 19th century to more than 70 000 people today, cf. Table 1. The city boundary was extended both in 1921 and 1965. In particular the latter enlargement increased the city's population substantially.

2.5 Housing market regulations[10]

Price regulations of the Norwegian housing market have not been substantial over the period from 1819 to 1989 as a whole. However, in some sub-periods housing has been subject to massive regulations. This is in particular the case for the period from 1940 to 1969, when sale prices on almost all types of real property were strictly regulated. In the first half of this period house prices were more or less frozen at the pre-WWII level. Rents have also been controlled in several periods. First, in the period from 1916 to 1936 rent control applied for some types of flats. Then, from 1940 onward rents on unfurnished flats in elder buildings in some cities have been regulated. The scope and

[9]This section is mainly based on Garmann Johnsen (2002).

[10]See e.g. NOU (1981) and Gulbrandsen (1980) for more details on the Norwegian housing market regulations.

extent of these regulations have been gradually reduced, and for the period 1985-2010[11] the law has been/is in force only in Oslo and Trondheim. The housing market has also been subject to other regulations than price regulations from time to time. For instance, in the period 1976-1983 it was forbidden to convert rental apartment blocks and housing co-operatives into condominiums.[12] Table 2 summarizes the main features of the housing market regulations.

Table 2: Regulations of the Norwegian housing market

Type of housing	Period	Type of regulation
Rental dwellings	1916-1935	Rent control on some types of flats.
	1940-2010	Rent control on some types of flats.
	1976-1983	Condominium conversion forbidden.
Owner-occupied dwellings	1940-1954	Prize freeze.
	1954-1969	Price regulations.
Housing co-operatives	1940-1954	Price freeze.
	1954-1982/88	Price regulations on new/old flats.
	1976-1983	Condominium conversion forbidden.

3 Data

Housing transaction data are compiled from the real property registers of the four cities. The data set covers transactions for the period from 1819 to 1989 for the sample as a whole.[13] Over this period the real property registers are stored differently for two sub-periods. For the period up to around 1935,[14] the real property registers are stored at the regional state archives (statsarkivene), while for the period from 1935 to 1989 the registers are scanned and made available through the internet by Norsk Eiendomsinformasjon AS.[15,16] In the real property registers information on all transactions of a property are

[11] The rent control law for old unfurnished flats was repealed in 1999, resulting in a gradual deregulation period until 2010.

[12] See e.g. Wessel (2002).

[13] Up until around 1989 the real property registers were recorded manually, whereas the registers are electronical from 1989 onward. Since existing Norwegian house price indices start in the mid-1980s, we have not collected data for the latter period.

[14] 1949 in Trondheim.

[15] At: www.infoland.no.

[16] Except for Bergen; the real property registers for Bergen were stored at the State Archive in Bergen also for the latter period at the time we collected the data.

recorded at the same place. Hence, repeat sales information on the properties are easily available within each of the two sub-periods.

The samples of the four cities start in different years in the 19th century, and they all end in 1989. The Bergen sample spans the longest period with annual observations from 1819, while the Trondheim sample covers the shortest, starting in 1897. For each of the cities except Kristiansand we have collected two samples of real properties; a sample of real properties with transaction data for the period up to 1935,[17] and another for the period 1935-1989. The samples for the two sub-periods for each of the cities, hereafter denoted the first period and the second period samples, respectively, are overlapping in the 1930s. The Kristiansand sample consists of the same real properties in both periods. For each sample we have aimed at getting a representative sample of real properties in the inner city of each city, where we define the inner city to be inside, or just by, the pre-WWII boundaries of the four cities, cf. Sections 2.1-2.4.

The way of choosing the samples has varied over cities and sample periods. The first period sample of Oslo consists of all real properties in some streets in different parts of the inner city, while the corresponding Bergen sample contains a set of randomly chosen real properties. The real properties in the first period Trondheim sample have been chosen as a mixture of the Oslo and Bergen procedures. For these cities the second period samples consist of all dwellings of some housing types in some inner city areas. The Kristiansand sample includes all real properties in nine streets of "Kvadraturen", cf. Section 2.4.

The samples consist mainly of residential buildings, although some non-residential buildings also are included in some of the samples.[18] Many types of housing are represented, from rental apartment blocks of many dwellings to single-family houses. Note that prior to 1970 most rental apartment blocks were sold as one unit, hence they get the same weight in the sample as for instance a single-family house. However, in the early 1970s and in particular from the mid 1980s many rental apartment blocks were converted

[17] For Bergen we have collected two samples of real properties for the period 1819-1935; a sample of properties which were transacted between 1819 and 1935, and, to increase the number of observations at the 19th century, an additional sample of properties which were transacted between 1819 and 1900.

[18] The share of non-residential buildings is the largest in the Kristiansand sample.

into multiple condominium units. Flats in housing co-operatives are not included in the samples, since transactions of these are not registered in the real property registers. The types of housing differ in the four cities, and they vary over time, cf. Sections 2.1-2.4. The housing types of the samples differ correspondingly.

We have recorded all transaction prices of each property in the sample, in addition to information on the property's attributes. More specifically, we have registered the price and the date of all transactions of the property, its' address, the size of its' yard,[19] and, when available, the year of construction, type of housing[20] and comments on the transactions, e.g. if the property has been sold to family members or if it is a part of the property which has been sold. In Tables 3 and 4 examples of the information we have gathered on two properties are shown. The house on the property *Claus Frimanns gate 4,* which is in the first period Bergen sample, is an inner city brick building constructed in the last decades of the 19th century. The property *Skippergaten 125* is in the Kristiansand sample, and it is a typical example of the dwellings in the wooden house area of "Kvadraturen".[21]

Table 3: Claus Frimanns gate 4, Bergen

Brick house; built in 1881.			
Date of sale	Price	Sqm	Comments
Apr 1898	15.800	150	
Jun 1910	14.610	165	Auction
Apr 1914	20.000	165	
May 1918	43.000	165	
Feb 1919	48.000	165	
Oct 1920	58.000	165	
Oct 1928	47.000	165	
Jun 1936	42.000	165	

The samples of the four cities consist of more than 21 000 transaction prices in total. The sample periods and the number of transactions in each sample and in total are summarized in Table 5.

[19]For the second period sample in Oslo we have registered the size of the dwelling unit, not the yard.

[20]For the real properties in the second period samples, information on the housing type and the year of construction of the *current* dwelling on the property is taken from: "Norges Eiendommer, 3/2003", published by Norsk Eiendomsinformasjon as.

[21]Garmann Johnsen (2002).

Table 4: Skippergaten 125, Kristiansand

Single-family wooden house of one-story; built in 1859.		
Date of sale	Price	Sqm
Jan 1883	4 210	261
Sep 1912	8 500	261
Mar 1918	15 000	261
Sep 1944	16 000	261
Apr 1957	33 000	261
Jun 1957	33 000	261
Feb 1971	80 000	261
Mar 1971	100 000	261
Nov 1978	542 000	261
Sep 1987	1 566 000	261
Dec 1988	1 400 000	261

Table 5: Sample description

	Sample period	No. of observations
Oslo	1841-1989	6 171
Bergen	1819-1989	6 720
Trondheim	1897-1989	4 239
Kristiansand	1867-1989	4 821
Total	1819-1989	21 951

Figure 1 plots the annual distribution of the transactions, both in total and for each city, over the period 1819-1989. Note that, with the exception of the Kristiansand sample, the number of transactions are not comparable before and after 1935 since the two sub-samples for each city are of different size. In addition, the sub-samples are partly overlapping in the 1930s. On the contrary, the Kristiansand sample consists of the same dwelling units in both sub-periods.

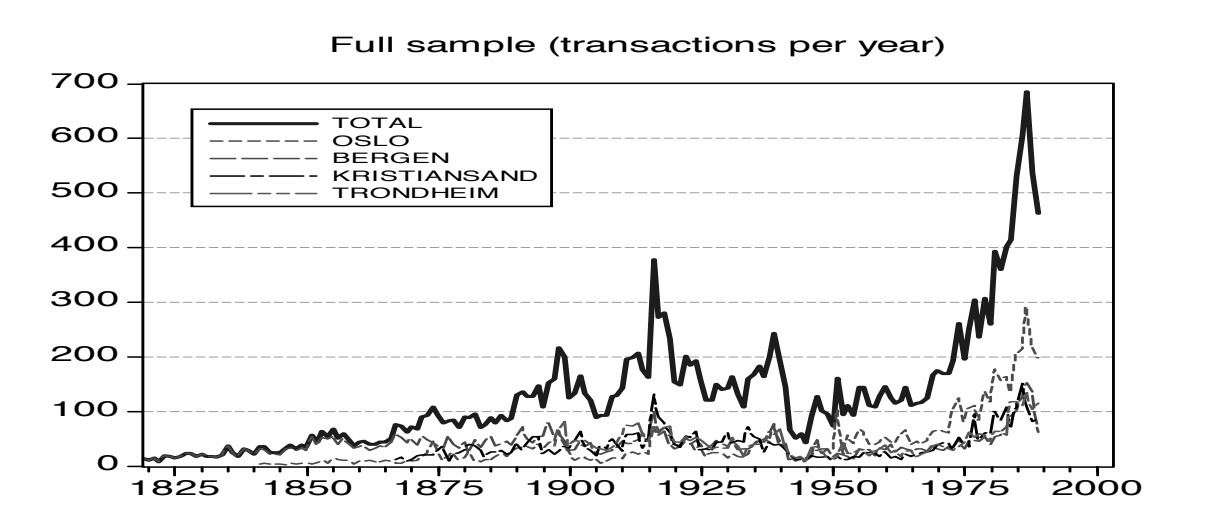


Figure 1: Transactions per year in the samples for Oslo, Bergen, Trondheim, Kristiansand and the total over the period 1819-1989.

The figure indicates that the activity in the housing markets have co-moved in the four cities in many periods. For instance, during World War I the turnover in the real estate market was high in all four cities, with 1916 being a peak year in three of them. During World War II all four cities experienced low activity in the real estate market. In the decades after WWII the pattern of the real estate activity was also similar in the

four cities; in the 1950s and 1960s the turnover in the real estate market was low, while it increased gradually in the 1970s before it took off in the mid-1980s. Conversion of rental apartment blocks and housing co-operatives into condominiums can partly explain the increase in the number of real property transactions at the beginning of the 1970s and in the mid-1980s.

While the activity in the real estate markets in the four cities share many common features, the cities have also some special characteristics. For instance, at the end of the 1890's the activity in the real estate market in Oslo boomed, before it busted after the turn of the century. Also the Bergen sample shows a similar, but milder, course over this period. The Kristiansand sample does not show an increase in the number of transactions at the end of the 1890s. On the other hand, many real properties were sold in 1892-94 in the city. This can partly be explained by that many burnt-out properties, or parts of these, were sold in the aftermath of the July 1892 fire. 1951 stands out as a year with many real estate transactions in the Oslo sample. This is due to that more than 80 of the observations in the sample are local government purchases of apartment blocks in an area of the city in November this year.[22]

4 Empirical approach

Different methods are applied in the literature for constructing house price indices. This is due both to the special characteristics of houses, being heterogeneous and infrequently sold, and data availability. Some house price indices are based on changes in the average or median price of houses which are transacted in different periods. However, such house price indices may suffer from composition biases, as houses of different types and quality may be sold in different time periods. It is thus more common to construct house price indices by the use of constant quality methods, like the repeat sales method or the hedonic method, or a combination of these two. Case and Shiller (1987, 1989), Eichholtz (1997)

[22]Most of these apartment blocks were resold to exactly the same price after a couple of years. We have excluded these transactions from the repeat sales sample.

and Røed Larsen and Sommervoll (2003) are examples of studies which use the repeat sales method for constructing house price indices. The Norwegian house price indices published by Statistics Norway and NEF/EFF/FINN.no/ECON are, on the other hand, examples of indices which are constructed by the use of the hedonic method. Among others, Englund et al. (1998) use a combination of repeat sales and hedonic methods to construct Swedish house price indices.

Repeat sales house price indices are based on repeated transactions of individual houses in the sample, while hedonic house price indices are based on detailed data of the houses' characteristics. Consequently, the hybrid hedonic-repeat sales method utilizes both repeat sales information and data on the houses' attributes.[23] As noted in Section 3, the real property registers in Norway are organized such that repeat sales information on the individual houses are easily available. The registers do however not contain much information on the houses' attributes. Thus, due to data availability we have chosen to use the repeat sales method, or a refined version of it - the weighted repeat sales method -, to construct the historical house price indices for the four Norwegian cities. To construct the aggregate index a hybrid method is applied, as in addition to use the repeat sales information of the total sample of the four cities, we allow the four cities to have different intercepts.

The main advantage of the repeat sales method compared to the hedonic method is that it does not require detailed data on the characteristics of the properties. Thus, the method relies less on characteristics which may be difficult to observe or to attain data on. Among the drawbacks of the method is that it wastes data. The repeat sales method uses only pairs of transactions of houses. Observations of houses which are sold only once over the sample period are thus not used. Another potential disadvantage of the repeat sales method is that houses which are frequently sold may be lemons, starter-homes or speculation objects, and represent houses of a different quality than the rest of the market. In addition, new houses are likely to be under-represented in the sample at the end of the

[23] See e.g. Shiller (1993) for a more thorough presentation of these methods.

sample period.

A more formal presentation of the weighted repeat sales method is given in Section 4.1, while the samples used for estimation are presented in Section 4.2.

4.1 The weighted repeat sales method

The repeat sales method was introduced by Bailey et al. (1963), and it is, as noted above, based on repeated transactions of individual houses. The method assumes constant quality on the houses between the two transactions in each transaction pair. Bailey et al. (1963) suggested to use the ordinary least squares method (OLS) on the following regression equation

$$y = x\beta + u, \tag{1}$$

where y is a vector of log price differences of n transaction pairs, x is an $n \times T$ matrix of time dummy variables which indicates the timing of transactions within the period indexed by $t = 1, \ldots, T$. Each row of the x matrix represents a transaction pair and take on the value -1 in the period of the first sale, +1 in the period of the second sale, and 0 otherwise. The time dummies in the base period are set to 0 for normalization. Furthermore, β is a $T \times 1$ vector of coefficients to be estimated, and u denotes an $n \times 1$ vector of model residuals. The residuals are assumed to have zero mean, constant variance, and be mutually independent. However, as noted in Case and Shiller (1987, 1989), the variance of the residuals may be related to the time interval between the sales, and hence the assumption of constant residual variance may be violated. Such residual heterogeneity may for instance be due to the fact that it is more likely that unobserved characteristics have changed for transaction pairs which span long time intervals.

Case and Shiller (1987) suggested a three-step procedure to adjust for this potential heterogeneity, in which transaction pairs of long time intervals are given less weight than transaction pairs of shorter time intervals.[24] The three steps of the weighted repeat sales

[24] It was first after the refinements of the repeat sales method by Case and Shiller (1987, 1989) that it

method are conducted as follows. In the first step, equation (1) is regressed by OLS. Then, in the second step, the squared residuals are regressed on a constant and the time interval of each transaction pair using OLS. In the third step we first divide each variable in equation (1), i.e. both the log price differences and the time dummy variables, with the square root of the fitted values from step two and reestimate the equation with OLS.

House price indices for each of the four cities are estimated with the weighted repeat sales method described above. The levels of the indices are represented by the $\widehat{\beta}$ coefficients from step three. Since the estimations are based on logarithmic values of transaction prices, the indices are in logarithms. Hence, to obtain appropriate levels of the indices we take the exponents of the coefficients.[25] The indices represent the expected values of geometric mean of the house price growth rates.

For constructing the aggregate house price index we use a hedonic-repeat sales method. Formally, we estimate an extended version of equation (1):

$$y = x\beta + z\gamma + u, \tag{2}$$

where z denotes a $n \times 3$ matrix of dummy variables for the different cities, where transaction pairs from the Oslo, Trondheim and Kristiansand samples take the value 1, respectively, and 0 otherwise.[26,27] γ denotes the associated 3×1 coefficient vector. The city dummy variables are introduced to allow differences in the price relatives in the transaction pairs of the different cities. The remainder of the equation is as before. We employ the weighted repeat sales procedure also in the construction of the aggregate house price index.

became common to construct repeat sales house price indices.

[25] I.e. $\text{Index}_t = 100 \times \frac{\exp(\widehat{\beta}_t)}{\exp(\beta_0)} = 100 \times \exp(\widehat{\beta}_t)$, where t is the time period and period 0 is the base period ($\beta_0 = 0$).

[26] Bergen is the base city.

[27] The z matrix could also include other hedonic variables which may help explain the price relatives in the transaction pairs.

4.2 The repeat sales samples

The real property transaction prices described in Section 3, or pairs of these, form the basis of the repeat sales indices. However, not all of the price observations in the full sample are used in the construction of the indices. First, since we construct annual house price indices, we use annual average prices when a property is sold more than once during a year. In our sample it is in particular during WWI that many dwellings were sold several times in a year.[28] Second, as noted above, only observations of a real property which has been sold more than once over the sample period are used in the repeat sales method. Single transactions of a house are hence excluded from the repeat sales sample.[29]

A third group of transactions which we do not include in the repeat sales sample is transaction pairs with changed quality on the real property. We have excluded transaction pairs of a real property if the size of the yard has been changed or if a new house has been constructed[30] between the two transactions. Ideally, we should also have controlled for other changes in the houses' attributes, such as depreciation, refurbishments, electricity and sanitary installations, etc. Unfortunately, data on such characteristics are not easily available.

In the early 1970s and in the mid-1980s a substantial number of rental dwellings and housing co-operatives in the cities were converted to condominiums. In the conversion process many tenantry or members of the housing co-operatives bought the flats in the condominiums to prices below market prices.[31] Many of these flats were later resold to market prices. To avoid that these transaction pairs disrupt the house price indices we exclude the first transaction of a condominium dwelling unit from the sample. The transactions of the real property *Erling Skjalgssons gate 3* in Oslo, which was converted

[28]For instance, the property *Nedre Møllenbergs gate 82* in Trondheim was sold thrice in 1918; in April for 54 000 NOK, in July for 62 000 NOK and in August for 69 000 NOK. The average 1918 transaction price for this property was hence 61 667 NOK.

[29]There are relatively few single transactions of houses in our samples, since the samples span long time periods.

[30]When we have information on this. In addition, we have excluded transaction pairs when we *believe* a new house has been constructed, for instance when the price of a property is multiplied from a year to another.

[31]See e.g. Gulbrandsen (1989) and Wessel (2002).

Table 6: Erling Skjalgssons gate 3, Oslo

6-story apartment block, built in 1899.			
Converted to condominium of eight units in Dec 1983.			
Date of sale	Price	Sqm	Comments
Mar 1917	112.500	2763	
Dec 1983	24.607	307	Unit no 1
Sep 1986	1.050.000	307	Unit no 1
Apr 1987	1.623.000	307	Unit no 1
Dec 1983	19.886	246	Unit no 2
Oct 1984	800.000	246	Unit no 2
Dec 1983	30.759	384	Unit no 4
May 1987	1.580.000	384	Unit no 4

to a condominium in December 1983, can be used as an example. As shown in Table 6, three of its' dwelling units were sold at the time of conversion. Within a couple of years the three units were resold to prices more than 40 times the conversion prices. These three transaction pairs are excluded from the repeat sales sample, whereas the second transaction pair of dwelling unit no 1 (the 1986-1987 transaction pair) is included. The repeat sales sample is reduced by a substantial number of observations at the beginning of the 1970s and in the mid-1980s because of this.

A fifth group of observations which is excluded from the repeat sales sample, are transactions between family members and transactions of a part of a property, when the part is unidentified. Also this latter group amounts to a substantial number of observations.

After we have removed observations according to these criteria, a total of 10 827 transaction pairs are used to construct the house price indices. Table 7 shows the number of transaction pairs in the samples in addition to some descriptive information, such as the average and median time intervals of the transaction pairs. The median time intervals of the transaction pairs are less than the average in all samples, and hence their distributions are skewed to the left. Figure 2 plots the repeat sales samples. Both transactions in each transaction pair are included in the figures.

Table 7: The repeat sales samples

	No. of transaction pairs	Time interval of transaction pairs: average	median	min.	max.
Oslo	2 816	13 yrs	8 yrs	1 yr	69 yrs
Bergen	3 690	16 yrs	12 yrs	1 yr	77 yrs
Trondheim	2 178	9 yrs	6 yrs	1 yr	58 yrs
Kristiansand	2 143	12 yrs	7 yrs	1 yr	86 yrs
Total	10 827	13 yrs	8 yrs	1 yr	86 yrs

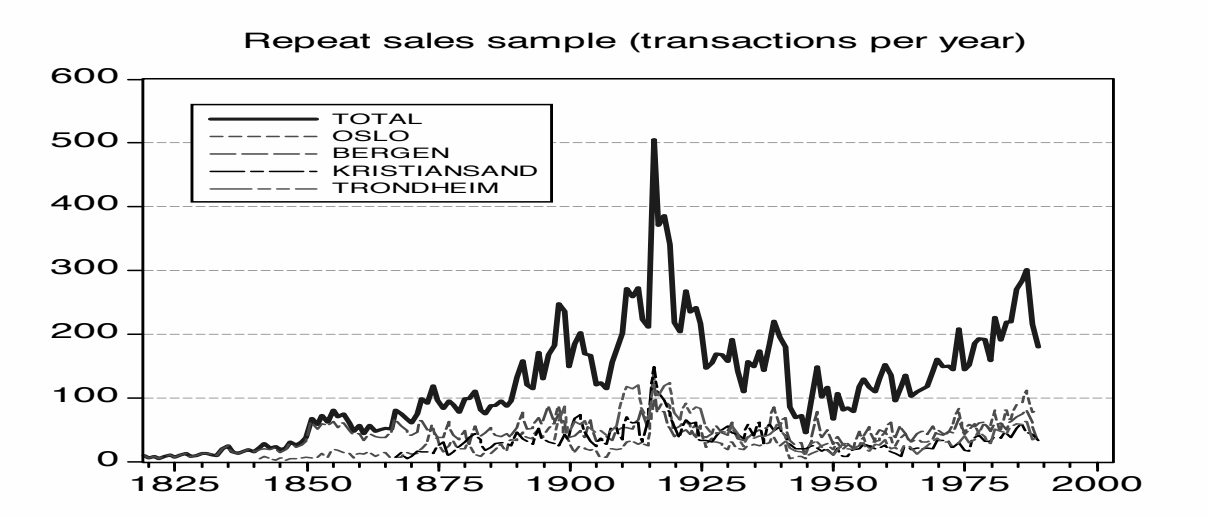


Figure 2: Transactions per year in the repeat sales samples for Oslo, Bergen, Trondheim, Kristiansand and the total.

5 The house price indices 1819-1989

As noted in Section 4.1, the weighted repeat sales method is used to construct the city house price indices, while a hedonic-repeat sales method is applied to construct the aggregate index.[32] Figure 3 displays the latter index in nominal terms (in logarithms) over the period 1819-1989. It shows that the house price trend has been increasing over the period as a whole. The shaded areas in the figure designate periods of high growth in nominal house prices. Typically, these periods have been associated with wars and boom periods in the economy. The growth in nominal house prices have in particular been large over the last two decades of the sample period.

[32]The aggregate index is estimated on the repeat sales samples for the four cities. The index is hence based solely on the Bergen data set for the period 1819-1840, on data for Bergen and Oslo for the period 1841-1866, and so on. The city dummy variables for Trondheim and Kristiansand are significantly different from zero on an 1% level, while the Oslo dummy variable is insignificant.

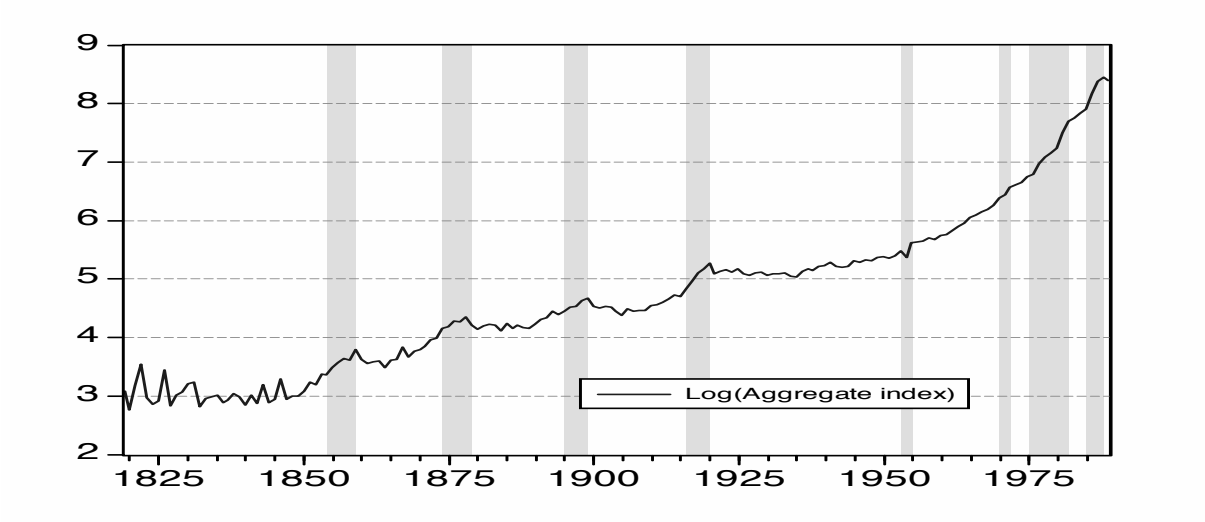


Figure 3: Aggregate nominal house price index 1819–1989 (logarithmic scale). The shaded areas designate periods with high nominal house price growth.

In Figure 4 the aggregate house price index in real terms, defined as the nominal aggregate index deflated by the CPI,[33] is plotted. This figure shows a somewhat different picture of the house price development over the last two centuries than the nominal house price index. The difference is in particular large in the first half of the 20th century. While nominal house prices trend upward in this period, the trend in the real house price index is declining. The city house price indices in real terms,[34] are shown in Figures 6(a)–6(d).

Figure 5 shows average growth rates over five year periods in the real house price indices (in percent). The figure shows that in the 19th century real house prices grew fast in the mid-1850s, the mid-1870s, and the mid-1890s. These boom periods were followed by periods of low, and sometimes negative, real house price growth. After the collapse of the housing market boom in Oslo around 1900 real house prices were virtually constant until WWI. Then, during the period of strong consumer price inflation under WWI, real house prices fell substantially. Average real house price growth was low until the late 1920s, when consumer price deflation caused a rebound in real house prices. As inflation picked up again in the 1930s and 1940s real house prices declined until the end of WWII. Real house prices increased eventually in the post-WWII period but showed only moderate

[33]The historical CPI is taken from Grytten (2004).

[34]Defined as nominal city house price indices deflated by the CPI from Grytten (2004).

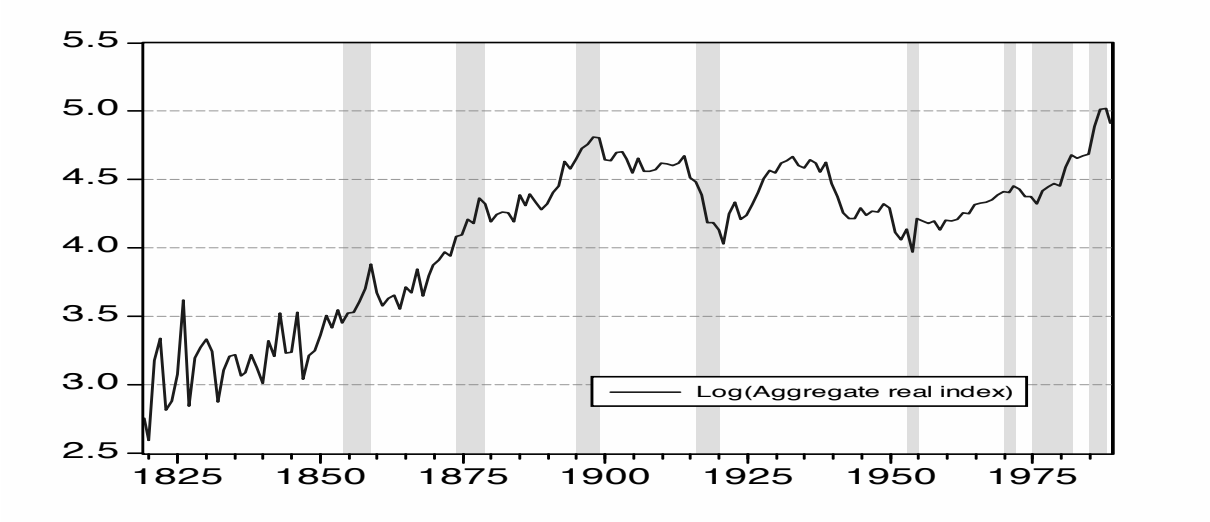


Figure 4: Aggregate real house price index 1819–1989 (logarithmic scale). The shaded areas designate periods with high growth in the aggregate nominal house price index.

growth during the 1950s and 1960s. With the exception of Kristiansand, where real house prices picked up in the late 1950s and early 1960s, the real house prices in the other cities showed rapid growth through the late 1970s and the 1980s. The growth was in particular strong in the Trondheim index.

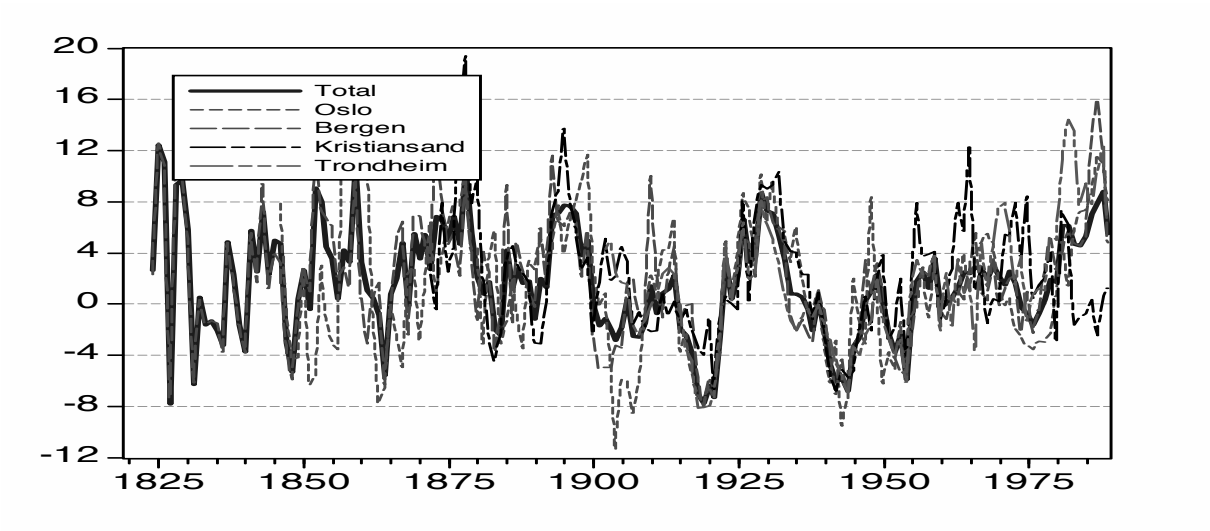
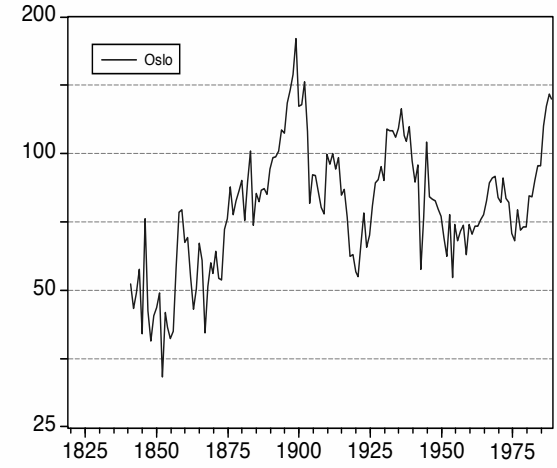
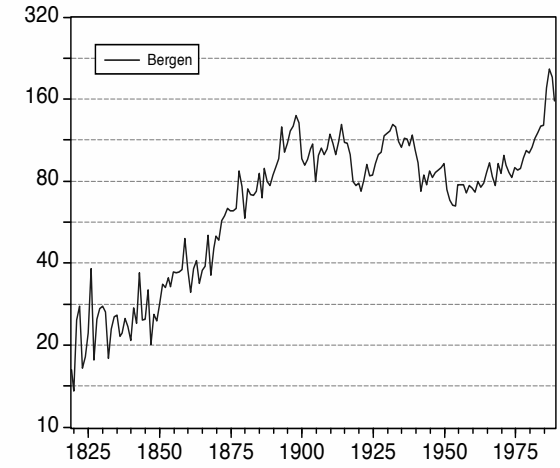


Figure 5: Real house price growth 1819–1989.

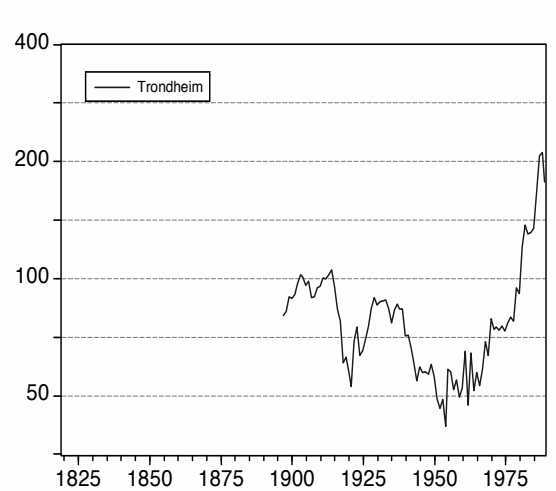
In the subsequent sections, we describe the house price indices for the four sub-periods 1819-1914, 1914-1940, 1940-1970 and 1970-1989 in more detail. Nominal house



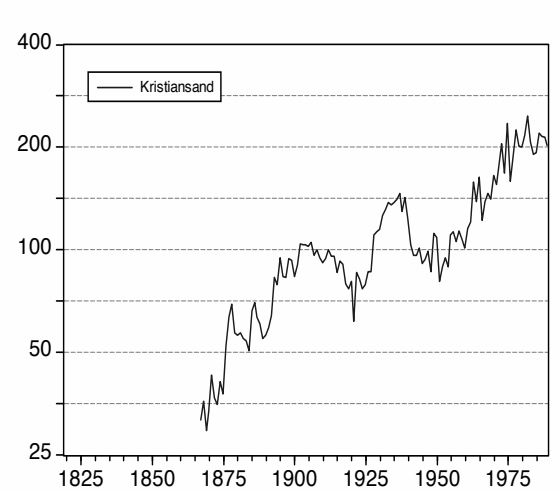
(a) Oslo



(b) Bergen



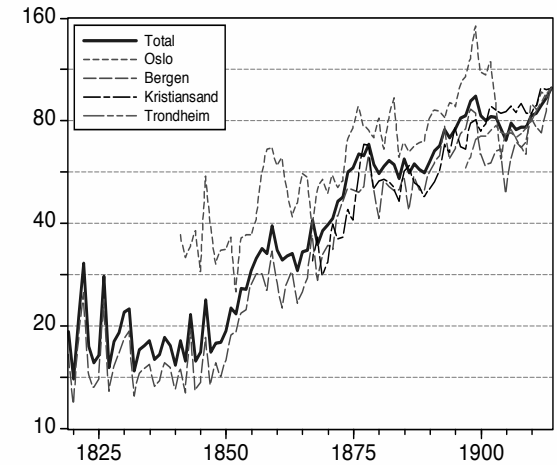
(c) Trondheim



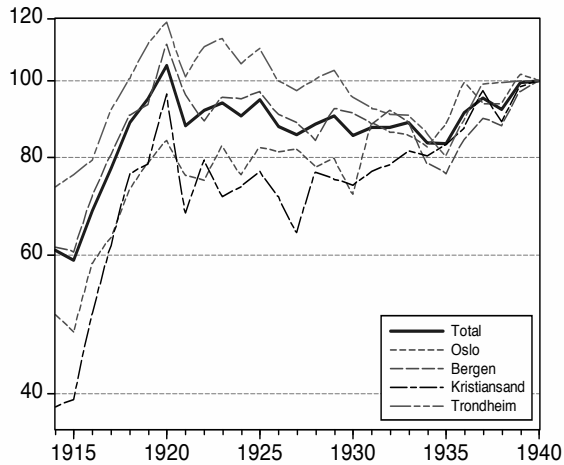
(d) Kristiansand

Figure 6: Real city house price indices 1819-1989 (semi-logarithmic scale, 1912=100)

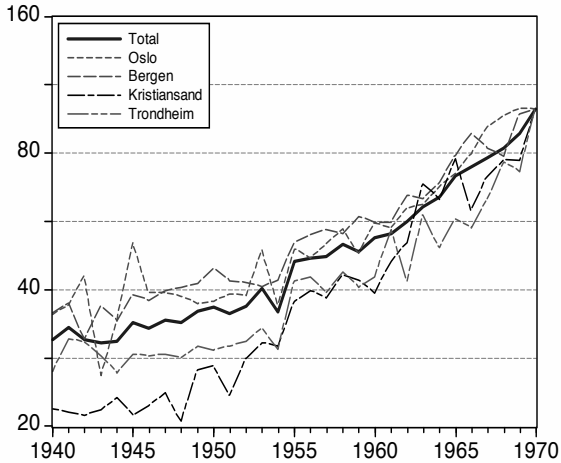
price indices for the four sub-periods are plotted in Figures 7(a)–7(d).



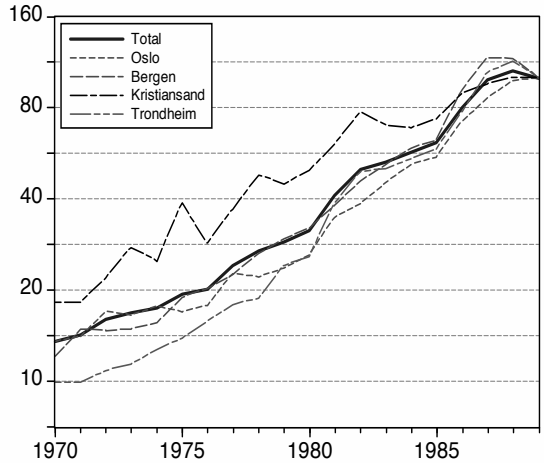
(a) Before 1914 (1914=100)



(b) 1914-1940 (1940=100)



(c) 1940-1970 (1970=100)



(d) 1970-2003 (2003=100)

Figure 7: Nominal house price indices for different sub-periods (logarithmic scale)

5.1 The period 1819-1914

The coverage of the city house price indices differ at the 19th century. The house price index for Bergen is the only index spanning the period from 1819 to 1841. In this post-Napoleonic War period the annual house price growth hovers about zero. The index is however very volatile in this period, probably due to few observations, cf. Figure 2. The nominal index does not recover substantially before the Crimean War in the 1850s. Also the house price index for Oslo, which starts in 1841, increases sharply during the Crimean War. Both house price indices decline after the war, and they do not rebound until the mid-1870s. The Kristiansand house price index, which starts in 1867, displays a similar rise in the mid-1870s. During the international depression period from the end of the 1870s to the beginning of the 1890s, the three house price indices flatten off again. Then, the Oslo house price index soars in the 1890s, in particular in the second half of the decade. At this time Oslo experienced a boom in the construction sector and fast population growth. However, after the turn of the century the index tumbles.[35] The Bergen house price index shows a similar, but milder, course over this period. The Trondheim house price index starts in 1897. Also the latter and the Kristiansand indices increase at the end of the 1890s. However, rather than declining in the first years of the new century, these two indices flatten off. All four city indices start to recover around 1910.

5.2 The period 1914-1940

The city house price indices share many common features during WWI and in the inter-war period. All four nominal indices increase sharply under and shortly after the war, and all four are temporarily peaking in 1920. However, the house price indices decline in real terms over this period; the nominal aggregate house price index increases by 72 percent from 1914 to 1920, while the CPI rises by 197 percent over the same period. Many of the properties in the samples are rental apartment blocks, and hence the decline in real house prices in this period may be related to the 1916 introduction of the rent control law, cf.

[35] This episod is often called the "Kristiania (i.e. Oslo) crash".

Section 2.5. During the 1920s, in which decade a national banking crisis took place, the nominal house price indices first fall sharply before they level out. All four house price indices recover in the second half of the 1930s. Real house prices increase in the inter-war period, cf. Figure 4.

5.3 The period 1940-1970

The Norwegian housing market was strictly regulated from 1940 to 1969, cf. Section 2.5. In the first half of this period house prices were more or less frozen at the pre-WWII level. The house price indices indicate that the price freeze served its' purpose, as the nominal aggregate house price index increased by a mere 15 percent from 1940 to 1954. For comparison, the CPI increased by 90 percent over the same period. However, the city indices show some differences in this period. In particular, the Kristiansand index grows more than the other indices from the end of the 1940s. Futhermore, the Oslo index is very volatile during WWII, probably due to very few observations in the Oslo sample for this period. Although both house prices and rents continued to be regulated after the cease of the price freeze in 1954, the indices make a jump from 1954 to 1955. Prices on owner-occupied houses were fixed by local price boards until 1969. The scope and the extent of the regulations were however gradually reduced. Over the period from 1954 to 1969 all the house price indices increase substantially.[36]

5.4 The period 1970-1989

The nominal house price indices increase sharply from 1970 to the end of the 1980s. In the 1970s the growth in nominal house prices is in large due to inflation, cf. Figure 4 which shows a flat development in the aggregate real house price index over this decade. However, during the period of credit liberalization in the 1980's the house price indices also increase sharply in real terms. At the end of the decade the house price indices

[36]Note that during the regulation period, a black market existed for purchase of real property. Hence, the registered transaction prices, which we base the house price indices on, could be lower than the actual prices the buyers paid during this period.

tumble, both in nominal and real terms. The Norwegian economy is often characterized as a boom-bust economy in this period, and a national banking crisis took place at the beginning of the 1990s.

The Kristiansand index is somewhat more volatile than the other city house price indices over the period 1970-2003. This index is also distinctive from the others in that it is declining from 1982 to 1984. The other indices level out in this period.

6 Concluding remarks

In this paper we have presented house price indices for four Norwegian cities from the 19th century onward as well as an aggregate house price index. The house price indices are based on real property transaction prices, which we have compiled from archives of real property registers for the four cities. Repeat sales information on the properties are easily available in the real property registers, and hence these registers are well-suited to use as a basis for historical repeat-sales house price indices. To our knowledge, this is the first attempt to construct continuous house price indices for Norway for such a long period, and also internationally there are few long runs of house price indices available.

The nominal house price indices seem to fit well in with historical events and available indicators of economic development in Norway. Typically, the nominal house price indices soar during wars and boom periods in the economy. The trend in the nominal house price indices is upward sloping over the sample period, and show particularly strong growth over the last two decades. In real terms, however, the picture looks different, especially in the first half of the 20th century. Housing market regulations may explain some of this discrepancy. Although there are some differences between the city house price indices in some sub-periods, the overall regional differences are small.

References

Bailey, M., R. Muth and H. O. Nourse (1963). A Regression Method for Real Estate Price Index Construction. *Journal of the American Statistical Association*, *58*, 933–942. Issue 304, Dec.

Bratberg, T. and J. Arntzen (1996). *Trondheim byleksikon (in Norwegian)*. Kunnskapsforlaget, Oslo.

Case, K. and R. Shiller (1987). Prices of Single-Family Homes since 1970: New Indexes for Four Cities. *New England Economic Review*, 45–56.

Case, K. and R. Shiller (1989). The Efficiency of the Market for Single-Family Homes. *The American Economic Review*, *79*(1), 125–137.

Eichholtz, P. (1997). A Long Run House Price Index: The Herengracht Index, 1628-1973. *Real Estate Economics*, *25*, 175–192.

Englund, P., J. M. Quigley and C. L. Redfern (1998). Improved Price Indexes for Real Estate: Measuring the Course of Swedish Housing Prices. *Journal of Urban Economics*, *44*, 171–196.

Friggit, J. (2001). *Prix des Logements, Produits financiers immobiliers et Gestion des Risques (in French)*. Economica.

Garmann Johnsen, V. (2002). *Arkitekturguide for Kristiansand (in Norwegian)*. Kulturdirektøren, Kristiansand kommune, Kristiansand.

Grytten, O. H. (2004). A Consumer Price Index for Norway 1516–2003. In Eitrheim, Ø., J. T. Klovland and J. F. Qvigstad (eds.), *Historical Monetary Statistics for Norway 1819–2003 (Chapter 3)*. Norges Bank Occasional Papers No. 35.

Gulbrandsen, L. (1980). Fra marked til administrasjon?: Boligpolitikk i Oslo i det tjuende århundre. (in Norwegian). INAS Stensil Doktorgradsavhandling, Institutt for sosialforskning, Oslo.

Gulbrandsen, L. (1989). Boligomsetning under nye rammebetingelser (in Norwegian). Notat 6, Institutt for sosialforskning (INAS).

Hagen Hartvedt, G. (1994). *Bergen byleksikon (in Norwegian)*. Kunnskapsforlaget, Oslo.

Hanisch, T. J. and H. Ryggvik (1993). Eiendomskrakket i Kristiania (in Norwegian). Working paper 62, Senter for teknologi og mennesklige verdier, Universitetet i Oslo.

NOU (1981). Prisregulering og ekspropriasjonserstatning. Fast eiendom. (in Norwegian). Nou 1981:5, Norges offentlige utredninger.

Røed Larsen, E. and D. E. Sommervoll (2003). Rising Inequality of Housing? Evidence from Segmented Housing Price Indices. Discussion Papers 363, Statistics Norway.

Shiller, R. J. (1993). *Macro Markets - Creating Institutions for Managing Society's Largest Economic Risks*. Clarendon Press, Oxford.

Tvedt, K. A. (2000). *Oslo byleksikon (in Norwegian)*. Kunnskapsforlaget, Oslo.

Wessel, T. (2002). Fra leie til eie - konvertering av leiegårder i norske byer (in Norwegian). *Tidsskrift for samfunnsforskning*, *43*(3), 299–331.

A Technical appendix: The data

Table A1. Real house price indices 1819-1989 (1912=100)

	Total	Oslo	Bergen	Trondheim	Kristiansand	Nominal CPI (Grytten, 2004)
1819	15.73		16.24			137.74
1820	13.37		13.62			117.39
1821	23.98		24.82			99.92
1822	28.22		27.82			121.78
1823	16.62		16.48			117.83
1824	17.78		18.12			98.56
1825	21.66		22.16			85.43
1826	37.28		38.32			84.49
1827	17.20		17.61			98.74
1828	24.38		24.95			82.98
1829	26.42		27.33			81.73
1830	27.94		27.85			88.43
1831	25.58		26.48			99.04
1832	17.66		17.89			94.13
1833	22.35		22.95			85.83
1834	24.68		25.49			79.82
1835	25.04		25.72			81.25
1836	21.46		21.52			83.81
1837	21.96		22.18			84.53
1838	24.94		25.17			83.72
1839	22.67		23.40			87.09
1840	20.34		20.83			84.93
1841	27.64	51.68	27.48			73.71
1842	24.73	45.70	24.06			71.61
1843	33.94	49.29	37.00			71.45
1844	25.26	55.66	24.81			70.48
1845	25.43	40.06	24.91			74.36
1846	34.17	71.97	31.90			78.65
1847	20.95	45.03	20.19			90.04
1848	24.85	38.72	26.06			80.88
1849	25.72	43.93	24.56			78.25
1850	28.80	45.79	28.43			75.47
1851	33.38	49.39	33.48			76.03
1852	30.47	32.25	32.53			80.18
1853	34.77	44.61	35.47			83.49
1854	31.46	41.49	32.83			91.84

Table A1. Real house price indices 1819-1989 (1912=100)

	Total	Oslo	Bergen	Trondheim	Kristiansand	Nominal CPI (Grytten, 2004)
1855	33.85	39.16	37.14			96.67
1856	34.06	40.60	37.01			104.20
1857	36.86	55.84	37.18			103.37
1858	40.48	74.43	37.84			91.05
1859	48.50	75.17	49.16			91.19
1860	39.36	63.78	38.00			95.48
1861	35.81	65.29	31.22			98.02
1862	37.73	53.53	38.17			95.59
1863	38.71	45.48	41.04			94.78
1864	35.00	50.46	33.76			93.52
1865	40.93	63.54	37.61			90.82
1866	39.35	58.17	39.11			95.71
1867	46.77	40.28	50.49		38.33	98.80
1868	38.42	51.05	36.11		42.75	101.88
1869	44.61	57.57	45.45		33.08	96.21
1870	48.14	54.50	50.42		40.64	92.43
1871	50.05	61.02	48.77		50.56	93.33
1872	53.02	53.11	57.44		43.89	98.93
1873	51.53	52.69	59.90		41.71	104.19
1874	59.29	68.00	63.62		48.38	107.51
1875	60.07	71.78	62.27		45.04	109.00
1876	67.15	84.44	62.51		61.77	107.08
1877	65.36	73.38	63.78		74.50	108.74
1878	78.76	78.85	87.37		79.12	97.88
1879	75.52	82.58	76.49		65.77	88.95
1880	66.16	87.44	58.43		64.86	95.61
1881	69.79	71.38	75.27		65.15	95.26
1882	71.02	86.75	71.67		61.84	96.83
1883	70.74	101.22	71.16		60.60	94.82
1884	66.16	69.70	73.67		56.44	92.37
1885	80.23	81.66	85.70		74.31	86.76
1886	74.37	78.31	69.73		78.02	85.19
1887	80.73	83.12	88.86		70.84	83.52
1888	76.38	83.61	80.05		66.56	85.01
1889	72.15	81.53	77.20		59.59	88.08
1890	75.49	92.57	84.64		60.60	90.44
1891	81.68	98.21	90.43		63.15	90.35
1892	85.95	98.38	96.56		70.11	88.69
1893	103.04	101.45	126.54		90.50	82.65

Table A1. Real house price indices 1819-1989 (1912=100)

	Total	Oslo	Bergen	Trondheim	Kristiansand	Nominal CPI (Grytten, 2004)
1894	97.64	113.04	102.04		85.50	82.30
1895	104.67	110.96	110.42		102.61	81.60
1896	112.86	129.18	122.73		89.13	81.16
1897	116.34	138.19	127.88	80.52	89.39	80.20
1898	122.54	149.24	139.90	82.39	99.61	83.87
1899	121.96	179.08	131.09	89.83	98.72	87.11
1900	104.02	127.33	96.59	88.88	87.05	89.83
1901	103.28	128.23	91.75	91.41	95.57	87.46
1902	109.69	144.11	96.08	97.66	109.20	84.84
1903	110.12	111.96	105.01	102.44	107.24	83.67
1904	104.46	77.79	109.88	100.79	106.99	81.63
1905	94.63	89.80	79.60	96.31	104.62	83.67
1906	105.06	89.69	99.51	98.57	102.41	84.55
1907	95.87	82.51	105.61	89.48	97.57	88.48
1908	95.82	76.23	99.96	89.97	107.19	90.38
1909	96.58	73.57	105.19	94.60	98.20	89.36
1910	101.35	99.84	119.42	95.64	93.60	92.27
1911	100.97	94.67	110.61	100.54	95.34	94.17
1912	100.00	100.00	100.00	100.00	100.00	100.00
1913	101.42	92.45	112.00	102.64	96.35	103.79
1914	107.38	98.00	129.08	105.55	96.81	104.96
1915	91.34	81.17	111.27	95.38	84.86	120.12
1916	88.58	83.50	110.04	83.64	91.75	143.15
1917	80.66	72.58	100.05	77.80	88.26	177.84
1918	65.67	59.48	79.91	60.78	76.73	249.85
1919	65.76	59.94	77.06	62.81	73.75	267.20
1920	62.26	55.00	78.80	57.49	77.38	311.37
1921	56.31	53.56	73.38	52.95	58.40	288.63
1922	70.18	62.96	81.11	68.85	79.54	241.98
1923	76.38	74.15	92.51	75.19	77.63	227.41
1924	67.11	62.09	83.91	63.66	72.30	249.27
1925	69.15	66.09	84.35	65.44	74.44	253.64
1926	75.07	76.83	92.72	69.87	81.30	215.74
1927	81.67	86.12	100.41	75.57	79.86	193.88
1928	90.39	87.63	102.47	83.94	103.76	180.76
1929	96.30	93.59	117.24	89.65	104.26	173.47
1930	94.25	87.38	119.57	85.74	106.95	167.64
1931	101.71	113.30	122.36	87.54	116.78	158.89
1932	103.66	112.33	129.60	87.77	120.92	155.98

Table A1. Real house price indices 1819-1989 (1912=100)

	Total	Oslo	Bergen	Trondheim	Kristiansand	Nominal CPI (Grytten, 2004)
1933	106.23	112.50	126.28	88.18	127.13	154.52
1934	100.02	108.75	112.27	83.62	124.90	154.52
1935	97.96	113.75	106.62	76.95	125.86	157.43
1936	104.27	125.45	114.89	83.14	127.89	161.81
1937	101.57	109.81	113.87	86.15	134.40	173.47
1938	95.16	106.39	107.86	83.82	118.09	179.30
1939	102.12	114.88	118.14	83.54	127.49	180.76
1940	87.65	96.44	104.33	71.38	110.58	211.37
1941	79.57	86.64	93.70	71.65	93.17	247.81
1942	70.49	94.32	73.69	66.67	87.01	262.39
1943	67.58	55.56	84.55	60.48	85.99	269.68
1944	67.51	72.32	77.68	54.68	91.74	272.59
1945	73.08	105.99	87.36	59.38	80.83	276.97
1946	69.22	80.36	82.74	57.35	83.94	284.26
1947	71.54	79.53	86.42	57.56	88.25	285.71
1948	71.06	78.76	88.20	56.74	77.73	284.26
1949	75.26	75.70	90.06	60.17	99.63	284.26
1950	73.19	72.87	92.71	56.02	96.20	298.83
1951	60.99	65.32	74.66	49.29	70.68	346.94
1952	58.10	59.41	68.08	46.47	80.26	377.55
1953	62.54	73.39	65.51	48.85	84.19	384.84
1954	52.94	53.33	64.70	41.77	78.58	402.33
1955	67.79	69.74	77.48	58.51	97.16	406.71
1956	66.57	64.33	77.85	57.82	97.82	421.28
1957	65.33	67.62	77.81	51.80	92.89	432.94
1958	66.36	69.57	72.69	54.90	99.22	453.35
1959	62.40	59.92	77.32	49.66	93.59	465.01
1960	66.75	69.78	75.31	52.34	91.72	465.01
1961	66.52	66.34	73.20	64.95	98.73	476.68
1962	67.14	69.34	79.79	47.36	105.94	502.92
1963	70.57	69.24	76.25	64.49	143.58	516.03
1964	70.21	71.71	78.51	51.71	121.01	545.19
1965	74.70	73.35	86.23	57.40	142.49	568.51
1966	76.02	78.67	93.53	53.11	107.64	586.01
1967	76.18	86.17	83.16	58.59	122.07	612.24
1968	77.51	88.38	77.23	68.93	125.84	632.65
1969	80.68	89.00	92.65	63.46	124.27	653.06
1970	82.52	79.94	85.80	78.77	142.37	723.03
1971	81.73	78.23	99.41	74.14	137.30	766.76

Table A1. Real house price indices 1819-1989 (1912=100)

	Total	Oslo	Bergen	Trondheim	Kristiansand	Nominal CPI (Grytten, 2004)
1972	85.90	88.24	91.50	75.32	146.86	822.14
1973	83.78	79.77	85.88	73.94	174.57	884.84
1974	79.53	78.04	82.82	75.44	139.57	967.93
1975	79.38	66.75	89.91	73.44	201.19	1 080.17
1976	75.15	64.20	88.14	77.00	134.06	1 179.30
1977	82.67	75.27	89.38	79.84	155.94	1 285.71
1978	85.29	67.91	97.27	77.76	189.15	1 390.67
1979	87.22	69.09	104.04	94.96	177.52	1 457.73
1980	85.91	69.00	101.82	91.68	165.83	1 616.62
1981	98.31	80.62	106.29	120.59	179.04	1 836.73
1982	107.95	80.53	115.06	137.51	200.68	2 045.19
1983	105.07	87.31	120.39	130.46	169.40	2 217.20
1984	107.07	93.92	127.65	131.77	154.02	2 355.68
1985	108.58	94.24	128.62	135.07	154.16	2 489.80
1986	132.74	115.10	176.17	167.43	171.95	2 669.10
1987	150.65	127.18	206.72	207.57	166.02	2 902.33
1988	151.21	135.52	192.59	210.99	160.56	3 096.21
1989	136.37	131.92	158.36	177.34	147.78	3 237.61

WORKING PAPERS (ANO) FROM NORGES BANK 2002-2004

Working Papers were previously issued as Arbeidsnotater from Norges Bank, see Norges Bank's website http://www.norges-bank.no

2002/1 Bache, Ida Wolden
Empirical Modelling of Norwegian Import Prices
Research Department 2002, 44p

2002/2 Bårdsen, Gunnar og Ragnar Nymoen
Rente og inflasjon
Forskningsavdelingen 2002, 24s

2002/3 Rakkestad, Ketil Johan
Estimering av indikatorer for volatilitet
Avdeling for Verdipapirer og internasjonal finans Norges Bank 33s

2002/4 Akram, Qaisar Farooq
PPP in the medium run despite oil shocks: The case of Norway
Research Department 2002, 34p

2002/5 Bårdsen, Gunnar, Eilev S. Jansen og Ragnar Nymoen
Testing the New Keynesian Phillips curve
Research Department 2002, 38p

2002/6 Lindquist, Kjersti-Gro
The Effect of New Technology in Payment Services on Banks'Intermediation
Research Department 2002, 28p

2002/7 Sparrman, Victoria
Kan pengepolitikken påvirke koordineringsgraden i lønnsdannelsen? En empirisk analyse.
Forskningsavdelingen 2002, 44s

2002/8 Holden, Steinar
The costs of price stability - downward nominal wage rigidity in Europe
Research Department 2002, 43p

2002/9 Leitemo, Kai and Ingunn Lønning
Simple Monetary Policymaking without the Output Gap
Research Department 2002, 29p

2002/10 Leitemo, Kai
Inflation Targeting Rules: History-Dependent or Forward-Looking?
Research Department 2002, 12p

2002/11 Claussen, Carl Andreas
Persistent inefficient redistribution
International Department 2002, 19p

2002/12 Næs, Randi and Johannes A. Skjeltorp
Equity Trading by Institutional Investors: Evidence on Order Submission Strategies
Research Department 2002, 51p

2002/13 Syrdal, Stig Arild
A Study of Implied Risk-Neutral Density Functions in the Norwegian Option Market
Securities Markets and International Finance Department 2002, 104p

2002/14 Holden, Steinar and John C. Driscoll
A Note on Inflation Persistence
Research Department 2002, 12p

2002/15 Driscoll, John C. and Steinar Holden
Coordination, Fair Treatment and Inflation Persistence
Research Department 2002, 40p

2003/1 Erlandsen, Solveig
Age structure effects and consumption in Norway, 1968(3) – 1998(4)
Research Department 2003, 27p

2003/2 Bakke, Bjørn og Asbjørn Enge
Risiko i det norske betalingssystemet
Avdeling for finansiell infrastruktur og betalingssystemer 2003, 15s

2003/3 Matsen, Egil and Ragnar Torvik
Optimal Dutch Disease
Research Department 2003, 26p

2003/4 Bache, Ida Wolden
Critical Realism and Econometrics
Research Department 2002, 18p

2003/5 Humphrey, David B. and Bent Vale
Scale economies, bank mergers, and electronic payments: A spline function approach
Research Department 2003, 34p

2003/6 Moen, Harald
Nåverdien av statens investeringer i og støtte til norske banker
Avdeling for finansiell analyse og struktur 2003, 24s

2003/7 Bjønnes, Geir H., Dagfinn Rime and Haakon O.Aa. Solheim
Volume and volatility in the FX market: Does it matter who you are?
Research Department 2003, 24p

2003/8 Gresvik, Olaf and Grete Øwre
Costs and Income in the Norwegian Payment System 2001. An application of the Activity Based Costing framework
Financial Infrastructure and Payment Systems Department 2003, 51p

2003/9 Næs, Randi and Johannes A.Skjeltorp
Volume Strategic Investor Behaviour and the Volume-Volatility Relation in Equity Markets
Research Department 2003, 43p

2003/10 Bjønnes, Geir Høidal and Dagfinn Rime
Dealer Behavior and Trading Systems in Foreign Exchange Markets
Research Department 2003, 32p

2003/11 Lindquist, Kjersti-Gro
Banks' buffer capital: How important is risk
Research Department 2003, 31p

2004/1 Sveen, Tommy and Lutz Weinke
Pitfalls in the Modelling of Forward-Looking Price Setting and Investment Decisions
Research Department 2004, 27p

2004/2 Andreeva, Olga
Aggregate bankruptcy probabilities and their role in explaining banks' loan losses
Research Department 2004, 44p

2004/3 Sveen, Tommy and Lutz Weinke
New Perspectives on Capital and Sticky Prices
Research Department 2004, 23p

2004/4 Bårdsen, Gunnar, Jurgen Doornik and Jan Tore Klovland
A European-type wage equation from an American-style labor market: Evidence from a panel of Norwegian manufacturing industries in the 1930s
Research Department 2004, 22p

2004/5 Holden, Steinar and Fredrik Wulfsberg
Downward Nominal Wage Rigidity in Europe
Research Department 2004, 33p

2004/6 Næs, Randi
Ownership Structure and Stock Market Liquidity
Research Department 2004, 50p

2004/7 Skjeltorp, Johannes A. and Bernt-Arne Ødegaard
The ownership structure of repurchasing firms
Research Department 2004, 54p

2004/8 Skjeltorp, Johannes A.
The market impact and timing of open market share repurchases in Norway
Research Department 2004, 51p

2004/9 Bowdler, Christopher and Eilev S. Jansen
Testing for a time-varying price-cost markup in the Euro area inflation process
Research Department 2004, 19p

2004/10 Eilev S. Jansen
Modelling inflation in the Euro Area
Research Department 2004, 49p

2004/11 Claudia M. Buch, John C. Driscoll, and Charlotte Østergaard
Cross-Border Diversification in Bank Asset Portfolios
Research Department 2004, 39p

2004/12 Tommy Sveen and Lutz Weinke
Firm-Specific Investment, Sticky Prices, and the Taylor Principle
Research Department 2004, 23p

2004/13 Geir Høidal Bjønnes, Dagfinn Rime og Haakon O.Aa. Solheim
Liquidity provision in the overnight foreign exchange market
Research Department 2004, 33p

2004/14 Steinar Holden
Wage formation under low inflation
Research Department 2004, 25p

2004/15 Roger Hammersland
Large T and small N: A three-step approach to the identification of cointegrating relationships in time series models with a small cross-sectional dimension
Research Department 2004, 66p

2004/16 Q. Farooq Akram
Oil wealth and real exchange rates: The FEER for Norway
Research Department 2004, 31p

2004/17 Q. Farooq Akram
En effisient handlingsregel for bruk av petroleumsinntekter
Forskningsavdelingen 2004, 40s

2004/18 Egil Matsen,Tommy Sveen and Ragnar Torvik
Savers, Spenders and Fiscal Policy in a Small Open Economy
Research Department 2004, 31s

2004/19 Roger Hammersland
The degree of independence in European goods markets: An I(2) analysis of German and Norwegian trade data
Research Department 2004, 45s

2004/20 Roger Hammersland
Who was in the driving seat in Europe during the nineties, International financial markets or the BUBA?
Research Department 2004, 35s

2004/21 Øyvind Eitrheim and Solveig K. Erlandsen
House prices in Norway 1819–1989
Research Department 2004, 35s

KEYWORDS:

Economic history
House prices
Repeat sales indices

Lobo Media - 31224