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Price concepts for Housing Cooperatives in a House Price Index

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Abstract

This working paper suggests what the price concept for housing cooperatives in a house price index should be by explaining four different price concepts

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1. Background

The original idea of owning shares in a company in Denmark comes from the agriculture sector, where groups of farmers jointly created dairies, butchers etc. This community idea is also the basis for housing cooperatives, where a community owns a real estate. Housing cooperatives were originally launched as a reaction to the miserable housing conditions in Copenhagen City in the early 1900's, where craftsmen and others jointly helped each other building dwellings in a co-operation where all the members rendered an effort by the construction of the dwellings. The original concept of a housing cooperative was to provide affordable and available dwellings to people with low incomes. As a member of a housing cooperative, you are committed not to make money on your dwelling because the next member should also be able to get a cheap dwelling. Because of the housing form and the low prices, housing cooperatives are popular and most housing cooperatives have internal waiting lists, where family members and friends to the members are given the priority to buy a share in the housing cooperative.

Today, in Denmark exist about 10,000 housing cooperatives containing about 200,000 dwellings in Denmark representing about 7 percent of the total housing stock in 2015. Housing cooperatives are concentrated in city areas. In Copenhagen City housing cooperatives hold about 33 percent of the total housing stock in 2015. For comparison, owner-occupied properties constitute about 29 percent of the total housing stock in Copenhagen City in 2015.

Definition

A housing cooperative is an association aiming to acquire, build/own and manage a real estate on a cooperative basis. Each member owns a share of equity in the housing cooperative and is liable for (a share of) the joint debt. The share in the housing cooperative gives *the right to use* a specific identified dwelling in the real estate owned by the cooperative.

2. Introduction

To our knowledge, there exist no studies of different "price concepts" for housing cooperatives to be used in a house price index. This paper identifies four different price concepts you can use for price index for housing cooperatives. You may wish to describe:

- The price of the certificate of ownership
- The price of all the acquired assets
- The price of the acquired real estate
- The price of the acquired dwelling

These four pricing concepts are all based on the transaction price of the certificate of ownership, but it differ how the transaction price is adjusted.

The four pricing concepts can be explained using a simplified example of a balance sheet for a fictitious housing co-operative. The balance sheet is the key to understanding the different pricing concepts - see the table below:

Table 1:

Assets	DKK	**Liabilities**	DKK
Real estate	10 million	Equity	5 million
Financial savings	2 million	Mortgages	7 million
Other assets	1 million	Other loans	1 million
Total assets	**13 million**	**Total liabilities**	**13 million**

Assumptions

In the following paper, it is assumed that the housing co-operative described in the table above has 5 dwellings (dwelling units) of the same size and quality and that there are 5 members who each own an equal share of the equity in the housing co-operative. The value of improvements in each dwelling made by the individual members is DKK 50.000. Each member therefore owns 1/5 of the equity of DKK 5 million, which is DKK 1 million – defined as the technical share of the equity for *membership i* (TSE_i). The value of the ownership certificate plus the value of individual improvements amounts are DKK 1.050.000.[2]

The following describe the four pricing concepts and relate them to different purposes:

3. The price of the certificate of ownership

The first possibility is to use the price of the certificate of ownership. In order to acquire a dwelling in a housing co-operative, you actually buy a share of the equity in the housing co-operative. This price concept is referred to as price concept 1.

The share has an observable transaction price[3]:

$$P_i^1 = TP_i \qquad (1)$$

where,

- P_i^1: Price for the share of the equity for *membership i*
- TP_i: Transaction price for the technical share of the equity for *membership i*

In our examples we assume that the transaction price TP is DKK 925.000, which is DKK 75.000 less than the technical share of the equity, which is DKK 1 million for each member. The technical value is the maximum price determined by the cooperation and in this case the certificate is traded at 75.000 less.

The price of the certificate is a fully observable price and is often referred to as the price of the dwelling but it is not the price of the dwelling. It is more like the price of a share in the equity of the housing cooperative.

[2] The maximum price that the share can be sold for according to the law in Denmark is equal to the technical share of the equity, which is DKK 1 million in this example.

[3] In this paper, *transaction price* always refers to the "certificate of ownership" and not to "all the acquired assets" or "the acquired property" or "the acquired dwelling".

4. The price of all acquired assets

A second possibility is to use the price of all the acquired assets. This will be referred to as price concept 2, which is identical to the price concept for housing co-operatives suggested by the detailed technical manual of the OOH-regulation (No. 93/2013)[4].

In view of the balance sheet, or specifically the accounting identity, the following holds on the assumption that the transaction price is a valid current valuation of the equity share: The price of assets acquired is the transaction price TP of the share in the cooperative plus the share of the gross joint debt in the housing co-operative[5]:

$$P_i^2 = P_i^1 + W_i \cdot GJD = TP_i + W_i \cdot GJD \qquad (2)$$

where,

- P_i^2: The price of all assets for *membership i*
- P_i^1: Price concept 1
- TP_i: Transaction price for *membership i*
- W_i: The share proportion of the equity for *membership i*
- GJD: The gross joint debt in the housing co-operative calculated as the sum of the mortgages and other loans (= borrowed capital).

In this method, the transaction price is adjusted with the acquired gross joint debt. Hence the price of all acquired assets is defined as the sum of the payment for the certificate plus borrowed capital.

Since we assume that the transaction price is DKK 925.000, the price of all acquired assets can be calculated as DKK 925.000 plus 1/5 of the gross joint debt of (7+1) DKK 8 million, which gives a total of DKK 2.525.000. This concept 2 price is higher than concept 1, as it includes the value of the acquired borrowed capital.

5. The price of the acquired real estate

A third possibility is to construct a price concept of the price of the acquired real estate owned by each member. This means that price concept must abstract from any other assets than the real estate itself. This will here be referred to as price concept 3. The assets in housing cooperatives typically consist of:

- Real estate (price concept 3)
- Financial assets
- Other assets

Real estate is here the only non-financial asset on the balance of the cooperation and the price of the acquired real estate can be calculated as the sum of the price TP of the ownership certificate plus the price of the acquired share of the *net* joint debt:

$$P_i^3 = P_i^2 - W_i \cdot OA \quad = TP_i + W_i \cdot NJD \qquad (3)$$

where,

- P_i^3: The price of the acquired real estate for *membership i*
- P_i^2: Price concept 2

[4] Eurostat does not distinguish between price concept 2, 3 and 4 mentioned in this working paper.

[5] You do not buy a share of the liabilities; you buy a share of the assets and pay by accepting the liabilities. The liability represents what you are going to pay. Total assets = total liabilities plus equity.

- W_i: The share proportion of the equity for *membership i*
- OA: Other assets than the real estate (financial assets + other assets)
- TP_i: Transaction price for *membership i*
- NJD: The net joint debt in the housing co-operative calculated as the sum of the mortgages and other loans (= borrowed capital) minus the value of financial assets. In principle, one should deduct any asset that is not real estate.

In this pricing method, the transaction price is adjusted with the net joint debt, i.e. gross joint debt consolidated with any other assets than the real estate.
For the use of formula (3), the balance sheet can be formulated so the net joint debt appears directly. The net joint debt is DKK 5 million (=7+1-2-1):

Table 2:

Assets	DKK	**Liabilities**	DKK
Real estate	10 million	Equity	5 million
		Net joint debt	5 million
Total assets	**10 million**	**Total liabilities**	**10 million**

The price of the acquired real estate can be calculated as the sum of the transaction price TP of DKK 925.000 plus the share (1/5) of the net joint debt of DKK 5 million. This gives a total of DKK 1.925.000. This price reflects the pure real estate price. The concept 3 price is smaller than concept 2 price as borrowed capital has been consolidated with non-real-estate assets.

6. The price of the acquired dwelling

A fourth possibility is to construct a price concept that relates to the dwelling that the buyer acquires *the right to use*. However, it is only the real estate that has a value in the balance sheet. The real estate in a housing cooperative will typically be a conglomerate consisting of the following units:

- Dwellings that cooperative members use (price concept 4)
- Dwellings that are rented out (lease of dwellings)
- Business units
- Commercial lease
- Cellars, garages etc. (can be price concept 4)
- Land area (can be price concept 4)

To calculate the price of the acquired dwelling, one must adjust the price of the real estate (concept 3) for any non-dwelling asset that the buyer acquires. This will here be referred to as price concept 4.

The price concept 4 can be calculated as price concept 3 multiplied by a correction factor:

$$P_i^4 = P_i^3 \cdot Corr_j = (TP_i + W_i \cdot NJD) \cdot Corr_j \qquad (4)$$

where,

- P_i^4: The price of the acquired dwelling for *membership i*
- $Corr_j$: Correction factor which has been adjusted for the real estate value not related to dwelling units. It can be business units, dwellings that are rented out including the share of cellars garages or land that relate to business or rented units etc. One may prefer to derive the price of the dwelling that the buyer acquires the right to use net of land, cellar and garage. However, the price statistics for private dwellings include the price of land, cel-

lar and garage. When included it is part of the quality adjustment to adjust for such quality differences between dwellings.
- Other variable description: See price concept 3

The correction factor in equation (4) is important because the dwelling units may lie in properties with different proportion of commercial units and rented dwellings, and because this proportion may change over time. Many housing cooperatives in Denmark have at least one rented dwelling unit in order to avoid tax on property gains.

If we assume that the correction factor is, for example, 0.4, the price of the dwelling unit can be calculated as the sum of the transaction price TP of DKK 925.000 plus the share (1/5) of the net joint debt of DKK 5 million, multiplied by the correction factor of 0.4. This gives a total of (DKK 1.925.000 multiplied by 0.4) DKK 770.000. This price reflects the pure dwelling price. This price is less than price concept 2 relating to all assets as borrowed capital (gross joint debt) has been consolidated with the financial assets and the real estate asset has been adjusted for non-dwelling units and for rented dwelling units.

7. Which pricing concept should be chosen?

The four pricing concepts can be seen as the transaction price of the certificate of ownership multiplied by an adjustment factor. The adjustment factors are shown below:

- Adjustment factor 1: $\frac{TP_i}{TP_i} = 1$ (5)
- Adjustment factor 2: $\frac{TP_i + W_i \cdot GJD}{TP_i} = 1 + \frac{W_i \cdot GJD}{TP_i}$ (6)
- Adjustment factor 3: $\frac{TP_i + W_i \cdot NJD}{TP_i} = 1 + \frac{W_i \cdot NJD}{TP_i}$ (7)
- Adjustment factor 4: $\left(\frac{TP_i + W_i \cdot NJD}{TP_i}\right) \cdot Corr_j = \left(1 + \frac{W_i \cdot NJD}{TP_i}\right) \cdot Corr_j$ (8)

To summarize the prices of the four different pricing concepts in the examples are:

- Price concept 1: DKK 925.000
- Price concept 2: DKK 2.525,000
- Price concept 3: DKK 1.925,000
- Price concept 4: DKK 770,000

The question is now, which of the four price concepts should be chosen as the price concept?

It is an advantage if the price for housing cooperatives refers only to the dwelling and is directly comparable with the price index for owner-occupied dwellings. Consequently, the price of the acquired dwelling (price concept 4) should be chosen as price concept.

8. The value of the net joint debt

It is difficult to obtain information about the market value of the outstanding net joint debt at the time of purchase of the dwelling. Instead, the net joint debt of the housing co-operative can be calculated *implicitly* as the value of the real estate minus the value of the equity according to the available balance of the housing co-operative. The following applies:

$$W_i \cdot NJD = (REV - EQ) \cdot W_i = REV \cdot W_i - \left(\frac{TSE_i}{W_i}\right) \cdot W_i = REV \cdot W_i - TSE_i \qquad (9)$$

where,

- W_i: The share in total equity for *membership i*
- NJD: The net joint debt
- REV: Real estate value
- EQ: Value of the equity
- TSE_i: Technical share of the equity for *membership i*

Notice that the technical value of the equity TSE_i is calculated as a share of the equity, meaning that $TSE_i = EQ \cdot W_i$

The symbol = in (9) is only valid if all values in the balance sheet are stated at the same time. If, for example, the net joint debt is measured at a current market value, but the equity is calculated using a different value for the net joint debt, equation (9) does not apply.

By inserting (9) in (4) we get the following:

$$\widehat{P}_i^4 = (TP_i + (REV \cdot W_i - TSE_i)) \cdot Corr = (REV \cdot W_i - (TSE_i - TP_i)) \cdot Corr \qquad (10)$$

Consequently, the price of the acquired dwelling can be calculated as the sum of the share of the real estate value minus the difference between the technical share of the equity and its transaction price, multiplied by the correction factor.

Since we assume that the transaction price TP is DKK 925,000, the price of the acquired dwelling can be calculated as 1/5 of the real estate value of DKK 10 million minus the difference between the technical share of the equity of DKK 1 million and the transaction price of DKK 925,000, multiplied by the correction factor. This is a total of (DKK 1.925,000 multiplied by 0.4) DKK 770,000, which is also the result in equation (4).

In this stylized example, there is no difference between (4) and (10) since all values in the balance sheet are consistent. In practice, there may be a difference between (10) and the original (4) based on current market values, but it is proposed to use equation (10) instead of the more accurate equation (4), because (10) is easier to use in practice.

9. Quality adjustment method

In order to establish a pure price index for dwellings in housing cooperatives, one should use a quality correction method that meets the three minimum requirements:

- The method must be able to take into account the fact that the same dwellings are not being sold in each period. Dwellings can differ by size, location and standard for which corrections must be made.
- The method must be able to take into account that dwellings are not part of housing cooperatives with the same economy. Corrections must be made with regard to differences in assets and liabilities in different housing cooperatives.
- There must be accessible data sources with the information required by the method.

The first and third issue also concern owner-occupied dwellings. However, the second issue concerns mainly dwellings in housing cooperatives as owner-occupied associations do not typically have a significant equity that would affect the price of the dwelling. Thus, the price of dwellings in housing cooperatives is a function of dwelling characteristics and housing cooperatives characteristics. The price of owner-occupied dwellings is only a function of dwellings characteristics:

- The price of dwellings in housing cooperatives:

$$Price = f(X_1, X_2) \quad (11)$$

- The price of owner-occupied dwellings:

$$Price = f(X_1) \quad (12)$$

where,

- X_1: Characteristics of dwellings
- X_2: Characteristics of housing cooperatives

The two characteristics will be further discussed in the following section. In theory, the only method that can adjust for all characteristics (X_1 and X_2) is **hedonic regression**, as only this method renders the possible of using dummy variables.

10. Quality characteristics of dwellings (X_1)

The challenge of producing house price index is that different dwellings are being sold in different periods. There is no standard product being sold again and again. The dwellings can differ by size, shape, location, quality of materials etc., for which corrections must be made. The qualitative differences can be divided into measurable/objective factors and non-measurable/subjective factors.

The measurable/objective variables:

- **Structural characteristics:** Year of construction of the property, size of the dwelling, number of rooms, heating, garage etc.
- **Environmental characteristics:** Noise, green areas, access to public transportation, distance to the railway, country/highway, views to sea, lake and landscape etc.
- **Neighborhood characteristics:** Standard of nearby schools, kinder gardens, crime rate, shopping opportunities etc.

The non-measurable/subjective factors:

- Design of kitchen and bathrooms
- Design and maintenance of the garden
- Trading skill of the real estate broker

The non-measurable factors can be considered as a part of the general uncertainty in the hedonic model.

11. Quality characteristics of housing cooperatives (X_2)

In order to adjust for the price impact of financial differences (different borrowing terms etc.) across different housing cooperatives all items in the balance sheet should, in principle, be corrected to take account of quality differences. Again one can start with the balance sheet exemplified by table 1 below:

Table 1:

Assets	DKK	**Liabilities**	DKK
Real estate	10 million	Equity	5 million
Financial savings	2 million	Mortgages	7 million
Other assets	1 million	Other loans	1 million
Total assets	**13 million**	**Total liabilities**	**13 million**

The items can be collected in three main items:

- Equity
- Net joint debt (mortgages + other loans - financial savings - other assets)
- Real estate

Each item is discussed below:

Equity:
The value of the cooperation member improvements in their "own" dwelling can be considered a quality change and thus a change in the volume rather than a change in the price. Furthermore, the value of these improvements is not part of the equity in the housing cooperatives. It is something that belongs to the individual member alone. Therefore, one can argue that the transaction price should be net of individual dwelling improvements. See the table below:

Table 3:

Example of the total price and the transaction price	DKK
Price of the certificate of ownership (equity)	1.000.000
Improvements in the dwelling	35.000
Plus / minus for good / bad state of repair	-5.000
Deducts for other defects	0
Price of movable property	20.000
Total maximum price (=maximum certificate price+quality changes)	1.050.000
Total actual price (transaction price)	925.000

Quality changes

In practice, one cannot distinguish between the price paid for the certificate of ownership, i.e. for the equity, and the price paid for the individual quality changes. The only available market price is the total actual price (bottom line) covering both the equity in the cooperation and the improvements in the individual dwelling.

Net joint debt:
The net joint debt should be corrected for differences concerning the composition and terms of the joint debt in the cooperation. The different joint debt conditions represent a quality difference affecting the demand and making the price of similar dwellings differ between housing cooperatives.

The joint debts conditions become important for the members if the housing co-operative gets into financial problems. The higher the joint debt is relative to the total assets, the greater is the risk that the housing co-operative gets into financial problems. The ratio between joint debt and asset is typically higher in new housing co-operatives, but there are exceptions. One way to correct for the joint debt-related risk is to create a dummy variable for whether the members are liable for more than the paid price (transaction price) and use this dummy as an explanatory variable in a hedonic regression.

The composition of the joint debt in housing co-operatives can differ in several ways. There may be different repayment profiles, interest profiles and financial instruments. In this way, the composition of the joint debt can be a quality factor supplementing the size of the joint debt. The market value of the joint debt is influenced by changes in the interest rate. This effect is much stronger in long-term loans - for example 30-years fixed rate mortgage - than in short-term loans - for example 5-years variable rate mortgage. One way to handle this is to construct dummy variables for different maturity groups and include them in a hedonic regression.

By financing with short-term joint debt or if the real estate is older then there is a particular risk that the monthly fee will increase in the near future and this can have an impact on the transaction price of the certificate of ownership. The greater the risk is for increased monthly fees, the lower will the price be for the certificate of ownership. One way to correct for some of the risk related to the monthly fees is to create a hedonic dummy variable indicating whether the housing cooperative have any major maintenance or improvement schemes for the next couple of years.

Real estate:
There are some special pricing problems because the real estate owned by the housing cooperative can be a conglomerate consisting of the following units:

- Dwellings that the members get the right to use
- Dwellings that are rented out (lease of dwellings)
- Business units
- Commercial lease
- Cellars, garages etc.
- Land area

To calculate the price of acquired dwelling, one must adjust for other elements in the real estate than the dwellings occupied by members of the housing cooperative. The difference between price concept 3 and price concept 4 is a correction factor – see below:

$$Corr_j = \frac{P_i^4}{P_i^3} \qquad (13)$$

Therefore, you cannot calculate price concept 4 without knowing the correction factor. However, it is not possible to calculate the true correction factor, it can only be approximated. In the context of hedonic regression one may use a set of variables describing the composition of the real estate:

- $DCorr_1$: Dummy for if the real estate only contains dwellings
- $DCorr_2$: Dummy for if the housing cooperatives have rental income
- $DCorr_3$: Dummy for if there are empty business units
- $DCorr_4$: Total area (M2) in the dwellings that the members get the right to use divided by the total area (M2) in the real estate
- $DCorr_n$: Others

Although price concept 4 is preferable, it may be better to calculate price concept 3 and use a hedonic regression with the variables just mentioned to approximate price concept 4. Thus, the transition from price concept 3 to 4 is left to the quality adjustment of a hedonic regression.

12. Conclusion

In this paper, it is suggested that the price concept for housing cooperative dwellings should be the price of the acquired dwelling (price concept 4) as this price concept comes closest to the price concept used in the price statistics of owner-occupied dwellings. Moreover, it is suggested to use hedonic regression to come from the price of the real estate owned by the housing co-operative to the price of the dwellings occupied by members of the housing cooperative.