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Valuation of Assets: Perpetual Inventory Method

Versus Market Prices

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Abstract: This paper discusses the problems involved in the valuation of assets from the costs side by means of PIM – with a special focus on buildings – when there is a market for used assets. During periods of recession the market price for real properties – land and buildings combined - could be lower than the PIM estimated values for buildings. A higher value for buildings than for real properties for the entire economy is not an economic meaningful result. PIM estimated values for buildings are in accordance with the SNA93. This paper argues that SNA should clarify that PIM alone is not necessary a good way to estimate the values of buildings.

I. Presentation of a problem

It may occur – typically in periods of economic recession – that it is impossible in connection with reselling a real property to obtain the price paid for construction of the real property after deduction of write-offs. In some cases, there are thus considerable losses incurred in connection with the resale of a real property, and they do not only occur in isolated situations, but may be a general phenomenon for the entire economy of a country. For assets traded several times during their economic life, and where the valuation of these is the costs involved in new acquisitions (with deduction of write-offs), a problem may arise, as the total value of these assets in connection with this calculation method might differ substantially from the market value.

In Denmark Statistics we have in connection with development of balance sheet calculated the value of land at market prices. The value of land is calculated by subtracting the value of buildings from the value of real properties estimated by using real market prices for real properties actually traded. The experience from Statistics Denmark shows that market prices of real properties are lower than the value of buildings for some years.

It applies, in principle, that all assets estimated after acquisition costs with deduction for write-offs can deviate from a possible market price in connection with a resale, and in the light of this there is thus a problem related to the estimation of values. The difficulty of estimating the value of buildings is that there is no independent valuation of buildings, but only an overall commercial value of real properties, without a sub-composition by the value of land and the value of building(s).

In our opinion the mentioned problem demands international discussion.

II. Example of real properties

On the basis of the example of real properties, land and buildings, it is shown below how deviating price developments for real properties and construction prices for buildings can give rise to problems. In this paper, the following terms are thus defined:

Definition of value of real property, buildings and land

Value of real property: The market price for real property comprising land and building(s).

Value of buildings: The value of capital goods for the building stock is measured by means of the written-down acquisition price as new (net stock) at current prices.

Value of land: The value of the land itself, excluding any buildings and constructions. This value is, in practice, estimated as the difference between the market price for real property and the value of building.

II.1 Valuation of buildings according to construction prices

The general method of estimating value of buildings when compiling fixed capital is to adopt the costs involved in construction the real property as basis, and subsequently write down the value over time as the result of ordinary wear and tear and technical obsolescence (consumption of fixed capital). Similarly, a revaluation takes place, due to price changes in connection with the construction of buildings. This is the main principle applied in estimating the value of assets by means of the PIM method. This method is broadly used and is recommended in paragraph 13.38 of SNA93:

(1) "In general, tangible fixed assets have to be recorded at current written down values… The common method of making these estimates is the perpetual inventory method (PIM), … When the PIM is used, the value of the stock of fixed assets on a given data is based on estimates of fixed capital formation, classified by type of asset and year of acquisition, that have been accumulated (after deduction of the accumulated consumption of fixed capital) and revalued over a long enough period to cover the acquisition of all fixed assets in the stock in question."

(2) "Where there exists an active market for a particular existing asset, the PIM calculation of the consumption of fixed capital should take into account the observed prices on markets for these assets when they are actively traded."

The second part of the SNA93 recommendation establishes that the market price for used assets must be taken into account, when the value of tangible fixed assets is calculated. The latter gives rise to problems in connection with buildings, as the "recycling market" only shows the value of real properties, but not the value of land and buildings, separately. This problem is further described in section II.3.

The standard PIM method is, subject to a few variations, used in Denmark – with respect to assumptions concerning economic lives, survival functions and linear write-off profile – for determining values of all fixed assets. Information on square meter and construction prices per square meter for determining (gross) stocks has been incorporated for buildings. However, this variation does not imply that the basic principle of using written-down acquisition prices has been deviated from, and the results do generally not differ from the standard PIM[1].

II.2 Valuation of real properties

SNA 10:13: To ensure consistency between the accumulation accounts and the balance sheets, assets recorded in balance sheets should be valued as if they were being acquired on the date to which the balance sheets relates. For example, if fixed assets were to be acquired on the balance sheet date they would be recorded at their current purchaser's prices, including any costs of ownership transfer, or at their current basic prices if produced on own account.

[1] See Dalgaard and Thomsen (2003).

The method of valuation of real properties used in Denmark Statistics is based on estimating a raising factor at the most detailed level, where the levels are property, postal code, municipal, county and national level. The raising factor is defined as the ratio between the observed sale price and the public real property assessment. At the level of property number, the raising factor is estimated as the ratio between traded property price and public real property assessment. From the level of postal code and upwards, the raising factor is estimated as the ratio between the sum of the traded real property prices and the sum of the public assessment of the traded real properties. The market price of a real property is equal to the raising factor, multiplied by the public real property assessment.

Real properties in Denmark are assessed by the Central Customs and Tax Administration, which is the responsible public authority. Up until 1996, the value of real property was determined by means of assessments carried out every four years. The year in which where public assessments were not conducted, the real properties were adjusted. As of 1998, values are determined by means of public assessments carried out every year.

The public real property assessment is nearly always lower than the market price. Consequently, the public real property assessment cannot be applied as market value.

In the balance sheets, the values of buildings and land should together correlate with the raised value of the real properties.

II.3 Valuation of land as a residual

In paragraph 13.54 of SNA93, land is defined as follows: *"Land is defined in the System as the ground itself, including the covering soil and any associated surface waters over which ownership rights are enforced. Excluded are any buildings or other man-made structures situated on it or running through it; cultivated crops, trees and animals; subsoil asset; non-cultivated biological resources and water resources."*

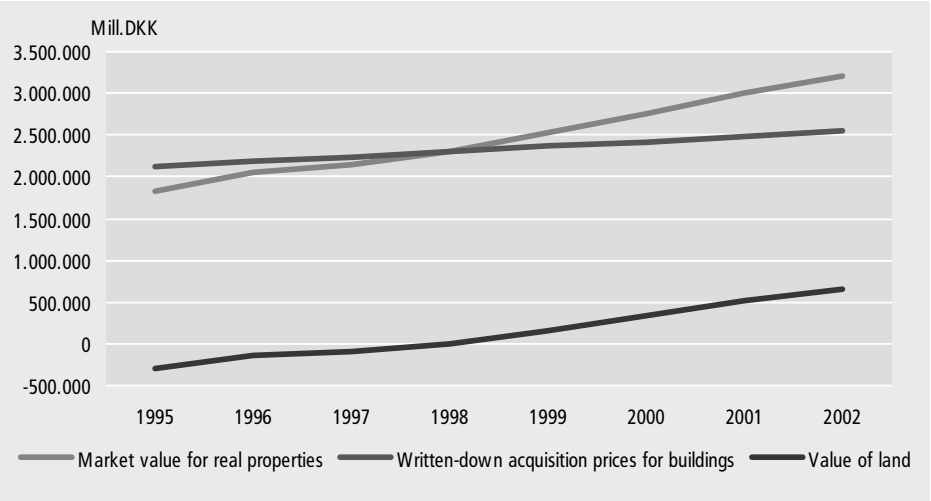
Paragraph 13.55 of SNA93 regarding valuation of land: *"….Land is valued at its current cost price paid by the owner, including written-down cost of ownership-transfer."*

An important prerequisite of estimating the value of land is that the price for land can be separated from the prices for buildings. This constitutes a problem. The price formation for areas in Denmark nearly always takes place as the price formation for a specific real property, and comprises land and building structures. It is impossible to make a separate valuation of, respectively, land and building(s), as building(s) are not traded exclusive of land, and undeveloped land is only traded to a very limited extent, and will therefore not be regarded as being representative.

As it is impossible to separate the value of land from the value of buildings in connection with sales of real property, it was the idea of Statistics Denmark to determine residually the value of land, as the difference between the market value of the real property and the value of buildings. The market value of real properties is described in section II.2. The value of buildings is determined by

means of written-down acquisition prices, see section II.1. Figure II.1 shows the result when the value of land is residually determined.

Figure II.1: Market value for real properties, written-down acquisition prices for buildings and value of land, 1995-2002.



There is a market for real properties in Denmark, and the valuation of real properties (at market price) is conducted by using information on observed prices for sales of real property. The number of real property sales is very high.

It appears from figure II.1 that the value of buildings, which is part of the market value of real properties, exceeds the market value of real properties for the period 1995-1997. That is, the value of land is negative when it is residually estimated.

From a logical consideration, it is not plausible to assume that the value of land for the entire economy is negative. The interpretation of negative value of land is that the individual house buyer derives an amount from the land in connection with the purchase of a given real property. The mechanisms of demand and supply in the real property market will not, in general, accept such a situation for the entire economy[2]. In periods of economic recession, it may occur that the value level of real properties falls in relation to periods of economic boom. The occurrence of the negative value of land hinges more on the calculation method used for buildings.

Assuming that the value of land cannot be negative, it must imply that the method for valuation of buildings by using written-down acquisition prices cannot be maintained.

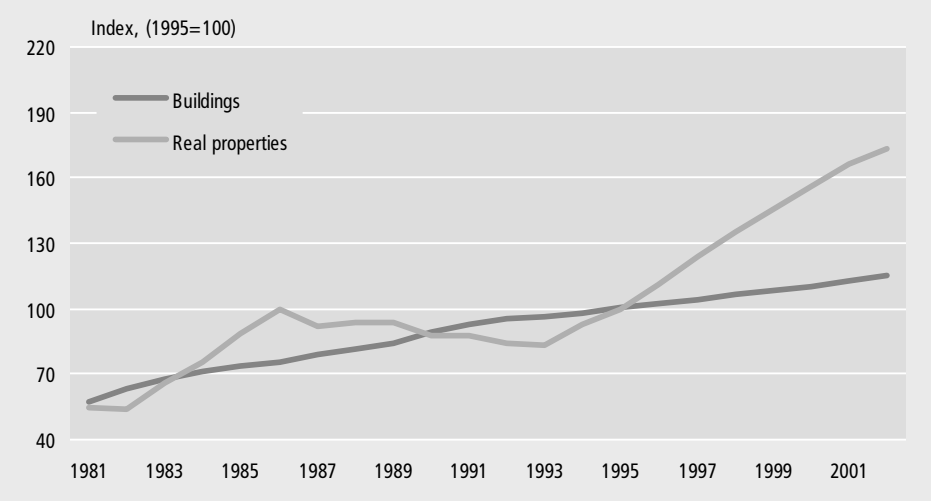
II.4 Major differences in the rate of price increases for buildings and real properties

The development in prices for, respectively, real properties and buildings is shown in the figure II.2. It appears that the price development for buildings

[2] Individual plots of land can have a negative value of land due to pollution and similar factors.

(measured by means of the implicit price index of investments in buildings) can vary substantially from the price development for real properties. Thus, the price development for buildings is considerably lower than the rate of price increases for real properties during the period 1993 and onwards. In the period where the rate of price increases for real properties is lower than the rate of price increases for buildings, losses can, however, be incurred if investments are made in real properties.

Figure II.2: Index of price developments for buildings and real properties (1995=100).



Note: Indices of price increases for real properties are calculated on the basis of all traded real properties in a given year, while price indices of buildings comprise the entire stock of buildings. Although there may be some composition effects, it is indisputable that the price development for real properties and buildings are not coincident.

Significant restraints in the rules for taxation applying to real properties and a general economic decline in the period from 1986 and up to 1993 implied that there were a considerable number of announcements of forced sales of real property and declining prices for real property over the period. Furthermore, there were clear indications that direct losses were incurred in connection with building new real properties in relation to the price at which they could immediately after construction be sold.

III. PIM and alternative valuations of assets

The SNA93 recommendations take into account the factor that a market price for an asset determined by means of the written-down market price may differ from the observed market prices for the assets. This appears from paragraph 10.13 of SNA93:

"…With good information and efficient markets, the written down values of an asset should equal, or at least approximate, both the present, or discounted , values of the remaining future benefits to be derived from them and their market values when active second-hand market exist. In practise, these values may differ from each other because lack of information or other imperfections. As already stated, the written-down value of an asset is generally the most practical and also the preferred method of valuing an existing asset, bearing in mind the calculation

of consumption of fixed capital should take into account the observed values of second-hand assets when they are actively traded."

However, please note that the recommendation only states that it is the *calculation of consumption of fixed capital"* and not the *"calculation of fixed capital".* Fixed capital should also be stated in order to make it quite clear that the stocks are adjusted in accordance with the market prices. Especially, when the recommendation of paragraph 6.200 is taken into account. Here, the possibility of revaluations due to price changes for used assets is not mentioned:

"Fixed assets figures prominently in the balance sheets of their owners. The values to be recorded in the balance sheets of the System are the net, or written-down values just described. To be precise, the value of a fixed asset shown in the balance sheets is the actual or estimated purchaser's price of a new asset of that type at the time the balance sheet is drawn up less the cumulative consumption of fixed capital incurred up to that time calculated with the reference to the same purchaser's price."

However, it is also stated in SNA93 that the ideal valuation of assets is the market price, see 13.29:

The ideal source of price observations for valuing balance sheet items is a market, like a stock exchange, in which each asset traded is completely homogeneous, if often traded in considerable volume and has its market price listed at regular intervals…. These prices are available for nearly all financial claims, existing real estate (i.e. buildings and other structures plus the underlying land),"

It can be concluded from paragraph 13.29 that the value of real properties (land and building(s)) should be valued at the observed market prices. And it is considered an ideal solution to apply the market prices for used assets. If only market prices for buildings are available, then these should be used.

Unclear recommendation in SNA

The 3 recommendations in each of the paragraphs 10.13, 6.200 and 13.29 point in different directions, and it can, at best be said, that the SNA recommendations are not homogeneous with respect to how buildings should be valued. However, the general impression of SNA is that market prices should be used, when they are available.

As described in section II.3, there is no real market price for buildings alone, and consequently alternatives must be considered. There are 3 proposals in paragraph 10.13 with regard to a value for an asset: 1) the written-down acquisition price, 2) the present value of future capital services from the asset and 3) the observed market price. In theory proposal 2) is a good approximation to market price, but it is also the one for which a calculation is subject to the greatest uncertainty, due to the requirement of assumptions for the future, which are principally unknown.

Section II has clearly outlined that the valuation in accordance with methods 1) and 3) are not always coincident.

IV. Question of principle: Is the building value to be adjusted in accordance with the economic trends?

Against the background of the results from section II, it seems obvious that general PIM calculations for the building stock, without taking into consideration – in one form or another – the development in market prices for used buildings implicitly resolved from the market prices, cannot alone form the basis for estimating the value for buildings in the balance sheets.

A clarification of 2 questions becomes urgent: 1) Can the problem be solved by revaluating the building stocks in accordance with the development in market prices. 2) Is this revaluation only to be applied in cases where direct losses are involved in connection with the construction of new buildings, or is this to apply at all times under survey, i.e. also at times when prices have increased considerably[3].

Are revaluations a solution?

Concerning question 1: If it is decided to compile the building stock in accordance with market prices, then the price level for the stocks from *the reacquisition price as new less the accumulated consumption of fixed capital* should be changed to *the observed market price as used*. This is acceptable, in principle, but it must be borne in mind that PIM calculations are generally conducted on the basis of constant prices, and these are also to be "revaluated". The calculation value at constant prices will then also have to be changed from *reacquisition price as new less the accumulated consumption of fixed capital* compiled at the prices applying in the reference year. It would be completely inexplicable not to make a change in the price value for stocks at constant prices: Why do stocks at current prices have to be *observed market price as used,* while the stocks at constant prices are *the reacquisition price as new less the accumulated consumption of fixed capital*? The change in price level from *reacquisition price as new less the accumulated consumption of fixed capital* to *the observed market price as used* give, in practice, rise to a change in the level of building stock at constant prices.

To this is added the problem of compiling the price development in the market price for buildings, as only the price development is, in principle, known for the market price for real properties, but not the sub-composition by, respectively, land and buildings.

Although the solution of revaluations is, in principle, possible and presumably also the right one, then the idea of making changes in the price level for stocks are, both comprehensive and subject to problems.

Asymmetric treatment

Concerning question 2: As previously mentioned, one of the main theses linked to estimating value of land is that the entire adjustment is attributed to the price for land, when real property prices are changed, due to the demand effects. However, the negative values of land show that this is not a valid assumption, and it is necessary to make adjustments to the stocks estimated on the basis of PIM, at least, for this period. The question is, do we have to deviate from this theory in times of economic boom? This is, fundamentally, an empirical question, which again is indirectly a question of sub-composition

[3] It seems impossible to conduct a residual calculation in reverse order – building value is estimated by means of the difference between property value and land value – as the number of sales involving undeveloped plots is very small in built-up areas. Against this background, the data material is not adequate for conducting a calculation. This would have been an optimum solution.

of the market price for buildings and value of land. However, this sub-composition will presumably, to a great degree, depend on assumptions, as the number of undeveloped plots that are traded is very low.

If the increase in real property prices cannot be empirically divided by, respectively, buildings and land, it is possible from a theoretical point of view alone to exclude positive revaluations of the building stock, which are considerably higher than the rate of increase related to the construction prices for buildings. There are different points of view at Statistics Denmark with regard to this question.

It is beyond any doubt that it is necessary to conduct adjustments in the building stocks compiled by means of written-down acquisition prices, when market prices are declining and value of land, which is residually estimated, becomes negative. In such cases, part of the decline must be attributed to the value of buildings.

V. Conclusion

The development work on compiling value of land for Denmark has implied that Statistics Denmark has become aware of the problems involved in compiling the value of fixed assets by means of PIM, when market prices for used assets are indirectly available, and when the price development for the used assets is not coincident with the price development for new acquisitions. SNA93 does not provide any solutions to dealing with this problem. Against this background, the following items can be summarized:

- Our estimates show that it is inexpedient to value stocks only by means of PIM, when there are significant differences in the price development between acquisition costs for new assets and used assets. The difference is most obvious in periods of economic recession and boom.

- It can, at best be said, that the description provided by SNA93 is unclear as to whether and, if this is the case, how market prices are to be incorporated into the calculations of stocks, when they are compiled by means of written-down acquisition prices (PIM).

- How are capital losses/gains for real properties to be distributed by, respectively, land and building(s), when the empirical basis for this distribution cannot be observed? International consistency in this domain is desirable in order to ensure data comparability. Is an asymmetric treatment, seen exclusively from a theoretical point of view, acceptable[4]?

If it is decided to deviate from the standard PIM and introduce market prices when estimating the value of buildings, the consequences for productivity calculations, estimation models and balance sheet measurement must be considered carefully.

[4] If an adjustment is not made so that stocks are calculated in accordance with the written-down acquisition prices, then there is also an implicit assumption with regard to the split-up between the value of land and the value of buildings for the overall real property.

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