



SEMINAR

Inflation Measures: Too High - Too Low - Internationally Comparable? Paris, 21-22 June 2005

9. Market prices and user cost

Rósmundur Guðnason
(Statistics Iceland)

Market prices and user cost

OECD seminar:

Inflation Measures:

Too High–Too Low–Internationally Comparable?

Paris, 21-22 June 2005

Rósmundur Guðnason

Statistics Iceland

Borgartúni 21a

IS - Reykjavík 150, Iceland

Tel: +354 528 1201

Fax: +354 528 1099

rosmundur.gudnason@statice.is

Preconference version, 16 June 2005¹

Abstract

This paper describes the framework for owner occupied housing in connection with different market price approaches to measuring user cost and problems connected with their use.

In addition it treats the problem of user cost from the point of view of the simple user cost approach to owner occupied housing . The simple user cost method uses a real interest rate as approximation to capital gains and measures depreciation by an inverted geometric rate. The prices are measured by a total house price index.

Few problem connected with user cost measurement are discussed such as he price divergence between rental markets and changes in house prices in Iceland.

Key words:

Consumer price index, cost of living index, household expenditure surveys, owner occupied housing, user cost.

JEL: C43, C81, D11, E31.

¹ I would like to thank Guðrún Ragnheiður Jónsdóttir for assistance in the preparation of this paper.

1. Approaches in calculating owner occupied housing

Measuring the share of owner-occupied housing in an index has two facets, as housing is used not only for residence but also as an investment, which adheres to its own particular set of rules. For this reason, value measurement of the use of owner-occupied housing has long been a problem when calculating consumer price indices, especially in small rental markets, such as the Icelandic one.

Two main approaches can be considered for computing the use of owner-occupied housing. One takes into consideration the service flow from residence in owner-occupied housing and includes *rental equivalence* and *user cost*, while the other includes *net acquisition*. What is common to both approaches is that market price is used to measure price changes; however, the approaches to calculating expenditure weights differ.

In countries where rental equivalence is used, information is taken from national accounts, based on rent surveys or housing owners asked what rent they feel would be paid for their apartment if it was rented, and the results obtained are used to derive weights. In cases where user cost is calculated, the annuity for the property base is used to determine the expenditure weight. In the net acquisition approach, on the other hand, the full price of the housing is capitalized in a single expense entry, creating the weight for that approach.

In all these instances, developments in the prices for owner-occupied housing are calculated according to changes in market price. In the case of rental equivalence, the reference is to changes in the rent paid for comparable housing, while in the case of user cost the reference is to the changes in market prices for bought housing, used as well as new. The net acquisition approach should theoretically be based on new housing. Real estate prices for new and used properties could easily change in a parallel manner, and then the same real estate index could be applied, in both the user cost and net acquisition approaches.

2. Market price methods to calculate owner occupied housing

The three market price methods used for these two approaches are rental equivalence, user cost and net acquisition

Rental equivalence is computed in many places where rental markets are strong and rental changes can be used for properties in the general market that correspond to owner-occupied housing. The rental equivalent then changes in accordance with the rent for those apartments. A necessary condition for this is i) that the rental market be large enough for there to be types and sizes of properties in the rental market which are comparable to those in owner-occupied housing, and that the market rent rate be used as an equivalent of rent changes for owner-occupied housing. ii) that the rental market not be controlled and that rent not be subsidized by the authorities or market prices governed in some other way. iii) that cost borne by landlords but not by tenants or those living in owner-occupied housing not be included in price measurements. The rental equivalence approach cannot be used in Iceland because of how small the rental market is and also because of the Icelandic market's difference in composition from what generally applies to owner-occupied housing. The majority of Icelanders, or about 80%, live in owner-occupied housing according to the household expenditures survey.

In instances where the rental market is small, the service flow from owner-occupied housing is often measured in terms of *simple user cost* (Diewert (2002), p. 621 and (2003) p. 28 and 53) in similar way as in the Icelandic consumer price index. The annuity (imputed rent) is computed from the property's market price, and the imputed housing rent is measured on the basis of certain real interest rates and depreciation. Real interest is the required return on (or opportunity cost of) capital tied up in the property or taken on credit. Property wear is taken into account by basing depreciation on an estimate of the lifetime of the property. Consideration is shown for use of the housing, or residence in it, but the return on the investment is calculated with the real long-term interest rate. Price changes are determined mostly by changes in the market price of all properties sold and to some extent by changes in real interest. The consumer price index measures short-term price changes, providing that there is no substitution between living in owner-occupied housing and renting, in other words that due to the tiny size of the rental market, it is not possible in the short-term to sell the housing and rent other housing instead. Although several countries calculate the housing in the index as a user cost, none of them use real

interest rates for calculating user cost except Iceland. In Iceland longer mortgages are usually indexed with the CPI. In some countries mortgage profiles are used but they only reflect the life time of the mortgage not the house and it is often very difficult to separate financing used for housing from other financing. Some countries use market prices of houses to evaluate depreciation or the mortgage rate. Housing cost can be valued in reference to *net acquisition*. The net item represents the housing that is built in excess of the housing that is depreciated. When calculating the consumer price index, housing is capitalized at the time of purchase, in the same way as other durables in consumer price index calculations. Price changes are measured based on the price of new houses, including housing the resident built and housing purchased directly from a builder or real estate broker. Furthermore, apartments bought from the business sector or public parties must be accounted for. This index is to some extent similar to a producer price index for buildings. The amount of new apartment housing built each year varies, depending among other things on the economic situation. The net changes might turn out negative in some years and thereby also the weights for new housing. If this approach is to be used, weights must be calculated as means over several years. Weight fluctuations are greater and relate more closely to economic cycles when the net acquisition approach is used instead of the user cost or rental equivalence approaches; moreover, the weight for owner-occupied housing normally comes out lower. (Diewert 2002a, p. 62). The change in house prices used with this method overestimates the house price change when real interest rates falls as their influence on house prices are not taken into account.

A payment method is sometimes used, especially if information is lacking on the market price of housing or on the housing market. By this method, the flow of payments for the purchase of housing is measured without normally giving attention to the funding of consumption when calculating the consumer price index. Attention is however given to payments for housing purchases, instalments, interest, maintenance and housing improvements. This approach is similar to the one used for the Icelandic consumer price index during the period of 1988 to 1992. Nominal interest, which in fact partly reflects inflation, is included, but no consideration shown to the distribution of housing use over a longer period.

In some countries housing is considered chiefly an investment, with the resulting argument that it should not be included in the consumer price index, so that owner-

occupied housing is left out of it. In some instances the countries do not have sufficient information on price changes in the property market to be able to apply any of the approaches described above. Owner-occupied housing has still not been included in the harmonized consumer price index calculated for the EEA countries, but there are plans to do so, probably by the net acquisition approach and with a price index for all properties sold.²

The methods used for the calculation of owner occupied housing differs as the share of households living in own housing. Following table shows the methods used in different countries and the share of owner occupiers (Hansen (2000), Housing Statistics (2004) and Christensen, Dupont, Schreyer (2005)).

User cost: Iceland (80), Ireland (78), United Kingdom (69), Canada (66). Finland (64) and Sweden (46).

Rental equivalence: Norway (77), United States (68), Japan (60), Denmark (51), Netherlands (54), Germany (45), Switzerland (31).

Net acquisition: United States until 1983, Australia (70), New Zealand (65), HICP from 2007.

Excluded: Italy (78), Spain (81), Greece (74), Luxembourg (67), Portugal (66), Belgium (68), France (56) and Austria (57).

3. Simple user cost

Owner occupied housing has two aspects. A house is a place to live in and at the same time an investment. To separate the measurement of the use from that of investment is a difficult problem in CPI calculation, especially where rental market is thin. The flow of service of living in own house is calculated as imputed rent in the Icelandic consumer price index, but the buying of the house is an investment and therefore not taken into account directly in the calculation.

The user cost method converts a part of the expenditure on a durable (such as a house) into flow of services by taking into consideration use of capital, long term financial (opportunity) cost (interest) and the use of the durable (depreciation).

² Eurostat's current suggestion includes among other things the following: "A price index for all dwellings purchased by households as a self-standing index." Eurostat (2004), p. 6.

In Iceland, the approach of calculating housing cost as a simple user cost was adopted in November 1992.³ To begin with price measurements for housing covered only the capital city area; since April 2000, however, they apply to the whole country.⁴ The main source when determining a base weight for housing is the official real estate assessment of housing, information on that being available from household expenditure surveys. The simple user cost is calculated in two steps. One is the calculation of the weight by using a real interest rate to measure the long term financial cost and the use of the durable. The other part is the price adjustment of the user cost weight (expenditure) by a house price index. Technically it is done by calculating this cost as an annuity.⁵ An annuity is a “ sequence of equal payments made at equal intervals of time” (Ayres, p.80). In the index calculation the property value is calculated as an annuity and includes both the real interest rate and depreciation. The annuity formula has the general form:

$$(1) P_H = A_{HV} * \left[\frac{(1+r)^N - 1}{r * (1+r)^N} \right]$$

where P_H is the present value of the house, A_{HV} , the annuity of the house value, where r is the real interest rate and N the life time of the durable (depreciation is given by an assumed lifetime of 80 years, and no scrap value in the end i.e. 1.25 per cent). The annuity formula (1) is derived from a geometric series and the interest is calculated over the lifetime of the durable and added to the durables value and then converted into equal payments (annuity). By using annuity both the interest rate and the depreciation are calculated from the same base and changes in the same direction when the property value changes. In addition the rent amount is also calculated over the lifetime of the durable. Lower lifetime of the durable (higher depreciation) leads to lower total interest rate.

³ A similar user cost approach was adapted by the National Economic Institute just after 1980, when inflation was high in Iceland, to measure the profitability of domestic fishing and fish processing.

⁴ In April 2000, an adjustment was made for having over-measured housing price changes on account of this; this adjustment lowered the index by about 0.35%. At the same time, an adjustment was made for having undervalued housing rents in the index, with the correction for this raising the index by around 0.34%.

⁵ This user cost method is in some ways similar as Steiner [29] suggested in the Stiegler report 1961. He uses in his user cost model the annuity method to measure depreciation and interest rates but does not use real interest rates.

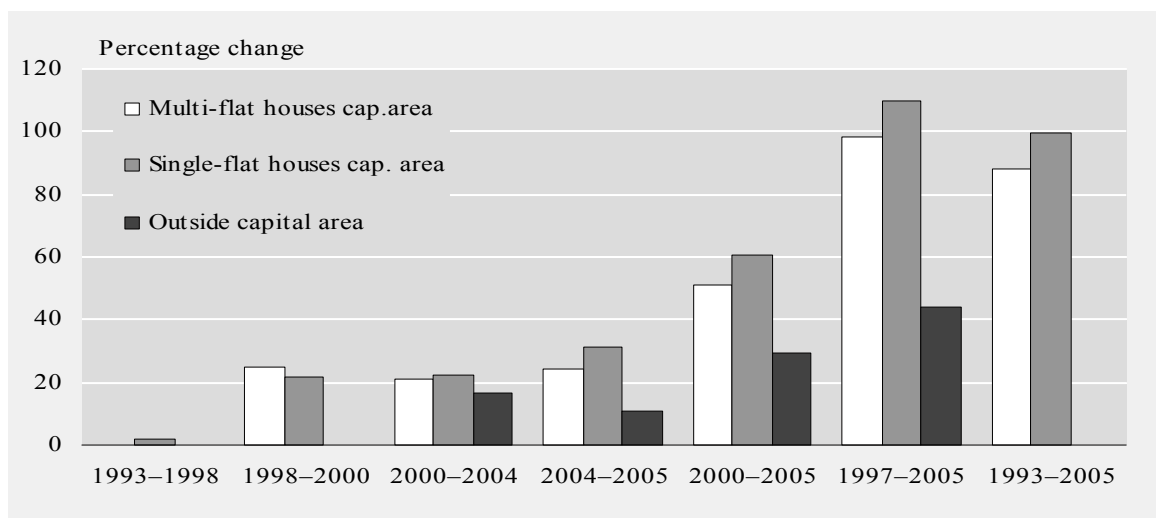
4. Housing prices and rentals

There has been a considerable house price inflation in Iceland in recent years as is shown in figures 1 and 2.

In real terms, house prices (deflated by the CPI less housing cost) in the period 1997 to April 2005 have increased by 98% for multi-flat houses and 110% for single-flat houses in the capital area. For houses outside the capital area, the average price change in the same period was 44%. The average price change for the whole country was nearly 85%.

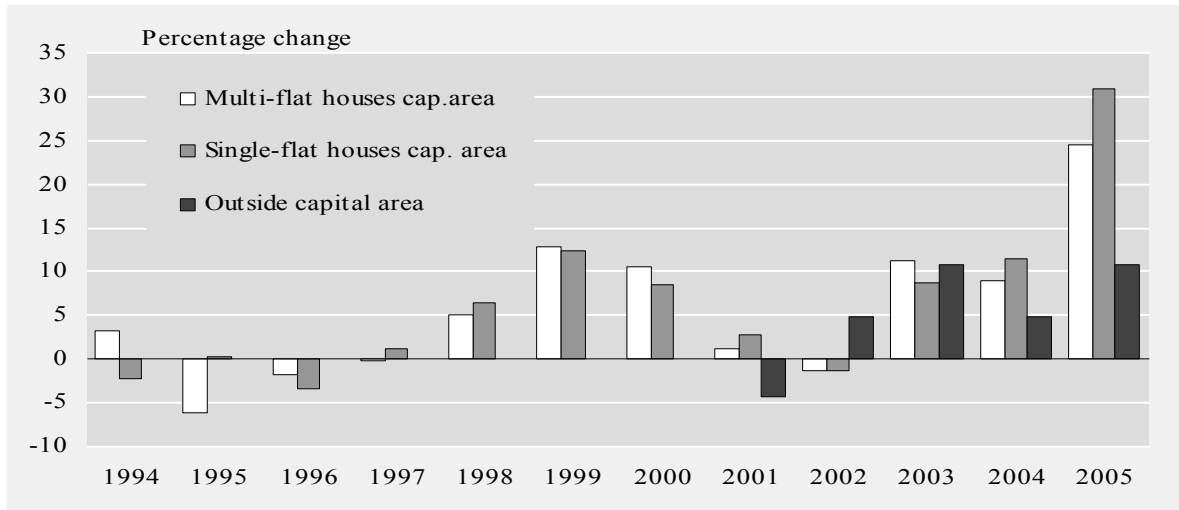
In the period 1993-1998 house prices were stagnant or fell slightly. In the period 1998 to 2000 there was 24% increase in house prices in the capital area in real terms and 17% outside the capital area in the same period. In the period 2000-2004 the average prices in the whole country rose by 20%.

Figure 1. Changes in real housing prices, deflated by the consumer price index less housing cost, changes over periods of years



Note: Prices outside the capital area were included in the index in March 2000. For 2005 prices in April.

Figure 2. Changes in real housing prices, 1994-2005, deflated by the consumer price index less housing cost.



Note: Prices outside the capital area were included in the index in March 2000. For 2005 prices in April.

Following the lowering of real interest rates in the period July- December 2004 and increased supply of loans the real house prices rose on the average from 2004 to April 2005 by nearly 25%.

Rental and housing markets are in theory two sides on the same coin and should therefore move in similar fashion. But that is not necessary the case. The durable stock can be different and there are costs in the rental market that do not face those living in own housing and should not should be included in the owners cost (Diewert (2003b), p. 47-50).

Until 2004 rental markets and house prices in Iceland moved in similar fashion. But changes in the loan market and lowering of the real interest rates led to a considerable price increase. Table 1 shows the price changes in the markets.

Rent increased more than imputed rent in the years 2001 to 2003. From 2003 this has changed and in the period 2004 to June 2005 housing prices rose more than 29%. When the effect of lower real interest rate through the user cost measurement is taken into account the imputed rent increase in the same period by just over 21%.

Table1. Rent, imputed rent and market prices in the Icelandic CPI, 2000-2005

Year	rent	change	imputed rent	change	marketprices	change	imputed/rent	market/rent
2000	134,7		139,0		136,8			
2001	146,8	9,0%	147,8	6,4%	145,6	6,4%	1,007	0,991
2002	159,5	8,7%	154,9	4,8%	152,6	4,8%	0,971	0,956
2003	175,4	9,9%	172,0	11,0%	170,4	11,7%	0,981	0,972
2004	189,2	7,9%	187,6	9,1%	188,3	10,5%	0,991	0,995
2005	200,3	5,8%	227,6	21,3%	243,5	29,3%	1,136	1,216

Today the share of imputed rent over rent is 13.6% but market prices are 21.6% higher the rent and real interest rates play important role in the price setting mechanism in the rental and owners occupiers markets. In the twelve month prior to June 2005 the effect of price changes of owner occupied housing in the CPI was 2.1%. If the effect of real interest rates on the CPI had not been taken into account, the increase in housing prices would have led to a 3.2% increase on the CPI but the effect of changes in real interest rates have reduced the price change by 1.1% or nearly one fourth. The average real rates used in the model were 4.0% in July 2004 and are 3.7% in June 2005. This differs from the market price approach used in the case of net acquisition because changes in real interest rates are not taken into consideration leading to overestimation of price changes when interest rates fall and vice versa when they rise.

The CPI measures price changes in household expenditures but does not take into account changes in households income. Two kind of income are connected to owner occupied housing. One is the imputed rent that is assumed that the owner pays himself for using the housing durable and the other on is the capital gain/loss the income from the price increase of the durable. In the full user cost approach this income from the use of the durable the capital gain is subtracted. This is natural in the case of firms as a part of measuring the profit of the firm but when it comes to households the same is not the case. Income is not subtracted from expenditures in the context of the CPI when the aim is to measure the changes in expenditures. The amount of money needed or available to cover the expenses is not measured so capital gains are not taken into account in that way.⁶ There are also substitution argument for not doing so as there are considerable hindrances moving over from own housing into tenancy. This is very important for Iceland were the privat rental market is very small and considerable difficulties in finding suitable

⁶ The same can be said about captial gain/loss from trading in shares.

apartments to rent. There are also very high cost connected with selling and buying, such as transaction cost.

In the case of the simple user cost the long-term real interest used in the calculation shows the return on the investment during the lifetime of the durable in real terms. With house price inflation also taken into consideration, the real interest rate reflects in this way the capital gain.⁷

Research into the use of the full user cost also shows that the results will also be very volatile (Gillingham (1980 and 1983), Johannessen (2004) and Verbrugge). One part of that is that in all cases nominal interest rates are used and the interest rates are not quality adjusted and the measured capital gain increase the volatile short term movements.

5. Real interest rate

If only nominal interest rates are known, they have to be adjusted for quality according to changes in inflation in order to determine the real interest rate. The subsequent changes in the consumer price index being subtracted to figure the real interest. In Iceland, real interest is preset, with the subsequent changes in the consumer price index being added to figure the nominal interest.⁸ Nominal interest rates reflect inflation, as well as risk and expectations, the higher the inflation, the higher the interest rates get. The fact, that a part of the price of using the capital is due to factors other than the service price for the use of money, makes the use of interest rates a quality adjustment issue. The quality issue in this case is that inflation is embedded in the interest rates and distorts the real interest value, making a quality adjustment necessary. The real interest rate from this point of view is the quality adjusted nominal interest rate. The quality adjustment is necessary as in the case of every good and service that has a better or worse quality reflected in its price.

The relationship between nominal and real interest is often expressed according to Fisher's equation (1896) (Diewert, 2003a, p. 21). The nominal interest rate is designed r_t , the real interest rate as r^* and the general inflation rate as p_t . The expression is:

$$(2) r_t = (1+r^*)(1+p_t) - 1$$

⁷ The capital gain can in certain periods be higher or lower than the required rate of return. The long-term real interest rate is an approximation of capital gain over the lifetime of a durable good.

⁸ Indexation is allowed only for financial obligations that are for five years or longer.

It means that the real interest rate, when not known, is the difference between the change in the nominal interest rate and the change in consumer inflation and the quality adjustment is expressed by calculating as follows:

$$(3) r^* = (1+r_t)/(1+p_t)-1$$

There could be a problem in the case of short-term movements. There are indications that the Fisher effect is not very strong in the short term even if it is so in the longer run (Mishkin 1992). If this is right the use of this method should probably be extended to some kind of average over a longer period of time.

When consumers buy real estate they finance it partly through their equity and partly with credit. The long-term real interest rate unites two leading factors in financing: the share which the buyer needs to finance by borrowing money and the required return on the buyer's equity. In the model for user cost, the share of each factor is based on information from the sales contracts used in price measurements the long-term real interest rate used in the simple user cost model shows the return on investment over the lifetime of the durable. In this way the real rate measures the capital gain. It can be lower or higher at periods than the rate of return used but it is approximated by the average long-term real interest rate.

The real interest rates used in the calculation of the simplified user cost are sticky over the lifetime of the durable but are partly kept variable to reflect short term trends in interest rates. When consumers buy property they finance it with equity and mortgages and the average long-term real interest rate in the model takes into account these two main types of financing. In the simple user cost model the division between these two forms of finance is mainly based on information from the sales contracts used for the house price measurement. As a result the opportunity financial cost covering the lifetime of the durable is estimated by keeping the equity rate fixed but allowing the mortgage real interest share to vary.

The required return on equity, which is constant over the lifetime of the durables, was determined in accordance with the long-term rate of return that pension funds require.

When this approach was adopted this rate of return amounted to 3% and been left unchanged for these calculations.⁹

Long-term loans from the Housing Financing Fund were revamped in July 2004 through the introduction of cash loans, so-called ÍLS securities offering a lower real interest rate than before and soon after that commercial and savings banks increased greatly their housing loans at competitive interest rates. The initial fall in mortgage rates was included in the Icelandic CPI in July but as of August 2004¹⁰ it was decided that the variable real mortgage rates, used in the calculation of the simple user cost of housing, should be calculated as a 60 month's moving average.

This decision was made in anticipation of frequent mortgage rate changes which might give rise to month-to-month volatility in the CPI. The feared volatility of real interest rates on housing credit has not materialized and the rates have over the recent months been stabilized at a substantially lower level than before. Statistics Iceland decided to change the method of averaging real interest rates in the model for owner occupied housing in the CPI as of May 2005. A twelve month moving average will be applied instead of the five year one introduced in August 2004. This change leads to a lowering of the Icelandic CPI by 0.45% in May 2005. The new method will be applied until the CPI is rebased in March 2006 when it will be reconsidered (Statistics Iceland (2005b)).

There are three parts that influence the results of the calculation of the annuity. House prices, interest rates and depreciation. The formula for the annuity is:

$$(4) \quad A_{HV} = P_H * \left[\frac{r * (1 + r)^N}{(1 + r)^N - 1} \right]$$

Dividing through it by $(1+r)^N$ gives the equation in the form:

⁹ The long-term rate of return of pension funds now lies between 2% and 3.5%. The assessment of long-term claims due to the Damage Compensation Act is 3.5%.

¹⁰ This corresponds with what has been done before in similar circumstances, such as at the end of 1993 when the interest rate on real estate securities fell from 6% to 5% and when, in the first half of 1995, the rate rose from 5% to 5.1%.

$$(4a) \quad A_{HV} = P_H * \left[\frac{r}{1 - (1 + r)^{-N}} \right]$$

The average real interest rate, measured monthly, has hovered around 4% since 1992. When changes in real interest occur, however, they have a direct effect on the annual payment. where A_{FM} is the base for the annuity and P_H the present value of the base (the discounted cash value in sales contracts), r the real interest and N the lifetime (in years). Increases in the average real interest rate, in the instance of a long lifetime, increase the annuity (the imputed rent) by just about the same ratio.

The real interest rate also influence the value of the property used as the base for calculating the annuity as lower interest rates normally lead to a higher house prices. In calculating the present value of the sale contracts the loans with fixed interest rates are discounted by rate of return reflecting the change in the real interest rate. A rise in the real interest rate lowers the present value of the property. This fact is in accordance with the economic reality that a higher real interest rate leads to less demand and lower price of housing.

6. Depreciation

It is difficult to find a depreciation rate that accurately reflects property wear, and this issue is always subject to considerable uncertainty. Generally speaking, three methods are common in deciding what the depreciation rate should be. The first way to approach this is to find out the property's age and by approximation estimate its lifetime, "*assuming a depreciation model that seems most appropriate.*" (Diewert, 2003b, 23). The second method bases on cross-sectional information to determine the depreciation rate, and the third method regards information on rental rates or the hire purchase of durables. The first method was chosen when the depreciation was decided that entered into computations of the simple user cost. "The first and simplest method is to impose a particular depreciation pattern on the average observed life of structures to derive a depreciation rate." (Malpezzi, Ozanne, Thibodeau, 1987, p. 373)

The depreciation rate used in the user cost calculation was obtained mainly by considering the age of the housing stock. According to the Real Estate Registry the stock at the end of the year 2001 has the following age structure: 90 per cent of all property is

constructed after the year 1940, more than one third in the period 1960-1980 and one third is constructed later. The depreciation rate seems therefore to be in accordance with age structure.

The depreciation rate was determined chiefly by reference to the construction year of the property base. According to the national registry of real estate from the end of 2001 (Ingvarsson, 2002, p. 261), the division of residential housing by the year of construction shows that about 90% of all properties were built after 1940, more than a third in the period of 1960-1980 and a little less than one-third after that. The premises regarding depreciation therefore seem to accord with the age groupings in the base according to the time of construction. The user cost covers both buildings and the land on which they are built. The depreciation is in fact 1.5% for real estate, which corresponds to a lifetime of about 67 years. Sites are not depreciated, as they do not wear out as time passes, and depreciation should only be calculated on the value of the building; however, the value of the site and the building are never separated in the price information upon which the housing index is founded. For practical reasons, a mean depreciation is calculated for the whole base, both building and site. The depreciation in the index is 1.25% of the real estate value. The value of land is separated in the real estate value calculated by the Land Registry and is approximately 15% of the total value of the house. In the future Statistics Iceland will consider separation of the value of land from the house value in the calculation of the user cost.

There are three most common depreciation methods: i) straight line depreciation when the depreciation is divided into equal shares, ii) one loss or light bulb depreciation when the durable is depreciated when it falls apart and iii) geometric depreciation when the durables value declines by constant percentage rate. The depreciation is usually in the form $(1 - \delta)^N$, where δ is the depreciation rate and N the lifetime of the durable (number of payments). It means that the depreciation is largest in the beginning. According to the geometric method the durable is never fully depreciated.

The form of the annuity formula is an inverted geometric depreciation of the type $(1 - \delta)^{-N}$ and it differs from the usual geometric depreciation in that it is small in the beginning but increases as the years go on.

The depreciation measured as the amortization of the principal (sinking fund), where $N = 80$, reaches the 50 per cent level in the 64th year. In the year 73 it covers two third of the total depreciation. The interest payment equals the depreciation amount in the 64th year and after that the depreciation amount is larger than the interest. The yearly depreciation measured this way is nearly 0.2 per cent in the beginning and around 4 per cent at the end.

It should be added that unlike the usual geometric depreciation the durable is fully depreciated. It is similar to the one hoss shay method as the depreciation is largest at the end of the durables lifetime and that the durable is fully depreciated but contrary to the one hoss shay method it depreciates over whole the lifetime of the durable.

7. Measurement of property prices

The Land Registry of Iceland calculates real estate value for all the property in the country. In the middle of the year 2001 the Land Registry revised the estimation method after extensive research, using hedonic regression. The base for the analysis was the capital area and the estimates for other parts of the country were calculated with regional coefficients (Fasteignamat (2002). P. 9 and p. 17-22) (Ingvarsson (2002), p. 31 and p. 259-270). The value of all properties in the country are measured in a harmonised way based on information about properties sold. This is done with reference to the law as “the law about the measurement of the real estate value says that it should be based on the market price of the property. According the first paragraph. of the law no. 6/2001 the estimated value shall be the discounted market value as estimated last November” (Ingvarsson (2002), p. 260). This basic information is the same as the one used for the price measurement of housing in the CPI and therefore the real estate value is very suitable for the user cost calculation.

Market prices are obtained from sales contracts that the Land Registry has collected for many years. They are suitable for this purpose because of being standardized and identical throughout the country. Every sales contract contains information on the property and its owners and the sales price, along with precise details on payment terms. Every property has a special, distinctive number which is used in the register of the Land Registry. These detailed data form a basis for the aggregate real estate value and form the grounds for measuring the market price of real estate in the consumer price index. Since the contracts are gathered through the offices of the District Commissioners upon being

registered, almost every concluded real estate agreement is obtained.¹¹ About 8,000-10,000 real estate sales contracts are closed annually, so that each year some 8-10% of all the housing in the country is bought and sold.¹² The price concept is the same as for other price measurements in the index, in that the price taken for computations is the one the consumer actually pays for goods and services, the price of the goods in cash. A sales contract details how payments are arranged; in fact, that information enters into figuring its present value. The basic reason for applying the present value is the fact that the value of money paid today is different from the value of money paid in the future.

The Land Registry of Iceland has collected the sales contracts over a long period of time. The information on market prices of properties received from them is used by the Land Registry as the base for their evaluation of all houses' real estate value. It is also used in the calculation of the simple user cost in the CPI.

The price concept used in the CPI is cash price. There are different forms of payments when a house is bought. As money received today is not the same as money received at a future point of time it is needed to calculate the present value of each contract. According to the market information the discount rates varies depending on the type of payment. The discount rate is measured monthly and if the change exceed a certain minimum it is changed. When the discount rate is lowered, the present value of the property increases and vice versa. Changes in the market prices and the discount rate influence the price measurement. The present value of the contract is used for the price updating of properties in the CPI. The price measurement concept is the same as in other parts of the CPI and the prices taken into account are those that the consumer pays in reality. In the long run the nominal and cash house price follow each other but within shorter interval they can divert temporarily.

The housing price index is computed from changes in the present value of real estate as declared in sales contracts. The greater part of the sales contracts serve in producing the imputed rent and the weighted national average.¹³ The calculation of price changes for real estate is a three-month moving average, with a one-month delay.¹⁴ April includes

¹¹ It is not only in the interest of buyers that a contract be registered but also a condition for credit services from the Housing Financing Fund and the commercial banks.

¹² Regardless of whether in terms of number or value.

¹³ This has been the case since March 2000. The index for the entire country was then recalculated back to March 1997.

¹⁴ Contracts from places outside the capital area, however, arrive with a two-month delay.

contracts from the period January to March, May contracts from the period February to April, and so on. Price information is gathered and the price change for imputed housing rent is estimated on the basis of all the sales contracts. This compilation keeps the category sizes fixed, based on what real estate was bought in each category during the last three years. What is measured is the change in price for single-family houses (a 13% weight) and multi-family housing (a 59% weight) in the capital city area (a 72% weight) and for single-family houses (a 15% weight) and multi-family housing (a 13% weight) outside the capital city area (a 28% weight). Emphasis is placed on comparing price developments within housing categories, not among types of property or among the different regions of Iceland. There are 8 categories for property size, giving altogether 9 sub-indices for housing in the capital city area and 8 indices by size category for property outside the capital city area. From both of these sets of indices, 4 overall indices are calculated for multi-family housing and single-family houses and inside and outside the capital city area. Thus 21 sub-indices are used when calculating the aggregate index for real estate prices.

References

- Ayres, Frank, JR., (1963), Mathematics of Finance, *Schaum's Outline Series, McGraw Hill Book Company*, May 1963.
- Barker, K., (2003), Review of Housing Supply. Securing our Future Housing. Interim Report – Analysis., HMSO 2003.
- Barker, K., (2005), The Housing Market and the Wider Economy, *State of the Economy Conference, Institute for Economic Affairs*, 24 January 2005.
- Central Statistical Office, (1994), Treatment of owner occupiers housing index in the retail price index, *Retail Price Index Advisory Committee*, December 1994.
- Christensen, A.K., Dupont, J., Schreyer, P (2005), International Comparability of the Consumer Price Index: Owner Occupied Housing, paper presented at the OECD seminar; Inflation measure: too high – too low – internationally comparable?, Paris, 21-22 June 2005.
- Diewert, W. E., (1998), Index Number Issues in the Consumer Price Index, 47-58, *Journal of Economic Perspectives* 12/1,
- Diewert, W. E., (1999), The Consumer Price Index and Index Number Purpose, *Journal of Economic and Social Measurement*, 27 (2001) 167-248.
- Diewert, W. E., (2001), The Consumer Price Index and Index Number Theory: A Survey, *Discussion Paper 01-02*, Department of Economics, University of British Columbia, Vancouver, Canada, V6T 1Z1.
- Diewert, W. E., (2002), Harmonized Index of Consumer Prices: Their Conceptual Foundations, *Swiss Journal of Economics and Statistics* 138:4, 547-637.
- Diewert, W. E., (2003a), Measuring Capital, *NBER Working Paper w9526*, Cambridge MA:NBER.
- Diewert, W. E., (2003b), The Treatment of Owner Occupied Housing and Other Durables in a Cost of Living Index, *Discussion Paper 03-08*, Department of Economics, University of British Columbia, Vancouver, Canada, V6T 1Z1.
- Fasteignamat ríkisins, (2002), *Árbók 2002*, Fasteignamat ríkisins 2002 (Land Registry of Iceland, Yearbook 2002, in Icelandic).
- Gillingham, R., (1980), Estimating the user cost of owner occupied housing. *Monthly Labour Review* 1980/February.

Gillingham, R., (1983), Measuring The Cost Of Shelter For Homeowners: Theoretical And Empirical Considerations. *Review of Economics and Statistics* XLV (2) 1983.

Goodhart, C., (2001), What Weight Should Be Given To Asset Prices In The Measurement Of Inflation , *The Economic Journal* 111 (June), F335-F356.

Guðnason, R., (2003a), How do we measure inflation? Some measurement problems, *International Working Group on Price Indices (Ottawa Group). Proceedings of the Seventh Meeting*, Paris, 27-29 May 2003. Thierry Lacroix editor, 289-320, INSEE, Paris, France, November 2001.

Guðnason, R., (2003b), Owner Occupied Housing: Market Price Approach To User Cost, Invited paper at the Joint ECE/ILO Meeting on Consumer Price Indices, Geneva, 4-5 December 2003.

Guðnason, R., (2004a), Simple User Cost and Rentals, paper presented at the Eight meeting of the International Working Group on Price Indices (The Ottawa Group), Helsinki, Finland, 23-25 August 2004.

Guðnason, R., (2004b), How do we measure inflation?. English translation of an article, Hvernig mælum við verðbólgu?. , *Fjármálatíðindi (the economic journal of the Icelandic Centralbank)*, 1, 2004, 33-54.

Guðnason, R., (2004c), Market price approach to simple user cost. *Statistical Journal of the United Nations ECE* 21 (2004), 147-155.

Hansen, B. C., (2000), The treatment of owner occupied housing in the CPI, final Report by Task Force XII, January 2000, Eurostat.

Hill P., (1999), Capital Stocks, Capital Services and Depreciation, paper presented at the third meeting of the Canberra Group on Capital Stock Statistics, Washington, D.C..

Housing Statistics in the European Union, 2003, (2004), National Agency for Enterprise and Housing, Copenhagen July 2004.

Hulten, C. R., (1990), the Measurement of Capital, *Fifty Years of Economic Measurement*, E. R. Berndt and J.E. Triplett (eds.), Chicago: the University of Chicago Press.

Hulten, C. R., F.C. Wykoff F.C., (1996), Issues in the Measurement of Economic Depreciation: Introductory Remarks, *Economic Inquiry* 34, 10-23.

Ingvarsson, Ö, (2002), Endurmat Fasteigna í júní 2001, Matsaðferðir við fasteignamat, gerð reiknilíkana og niðurstöður úr þeim, *Árbók VFÍ TFÍ 2002 (in Icelandic)*, 259-270,

- Reykjavík.(2002). (Revaluation of real estate in June, methods of evaluation for real estate, models and conclusions, *Yearbook VFÍ TFÍ 2002 (Association of Chartered Engineers in Iceland and Association of Chartered Technicians in Iceland)*, 259-270, Reykjavík.)
- Johannessen, R., (2004), Owner-occupied housing in Norway: Why the rental equivalence approach is preferred, paper presented at the Eight meeting of the International Working Group on Price Indices (The Ottawa Group), Helsinki, Finland, 23-25 August 2004
- Jörgenson, D. W., (1996), Empirical Studies of Depreciation, *Economic Inquiry* 34, 24-42.
- Jörgenson, D. W., (1967), The Theory of Investment Behaviour, in *Determinants of Investment Behaviour*, edited by Robert Ferber, National Bureau Of Economic Research, New York.
- Malpezzi S., Ozanne L., Thibodeau T.G., (1987), Microeconomic Estimates of Housing Depreciation, *Land Economics: Nov 1987; 63,372-385*.
- McCharty, J., Peach R.W., (2004), Are home Prices The Next “Bubble”? *FBNY Economic Policy Review*, December 2004, 1-17.
- Muth, R. F., (1972), On the Measurement of Shelter Cost for Homeowners in the Consumer Price Index, *Bureau of Labour Statistics, mimeograph, 1972*.
- Muth, R. F., (1975), The User Cost of Owner-Occupied Housing, *Bureau of Labour Statistics, mimeograph, 1975*.
- Smith, D. A., (1975), The Flow of Services Approach to Estimating the Homownership Component of the CPI, *Bureau of Labour Statistics, mimeograph, 1975*.
- Mishkin, F. S., (1992), Is the Fisher effect for real? A reexamination of the relationship between inflation and interest rates., *Journal of Monetary Economics, volume 30, Issue 2, November 1992, pages 192-215*.
- Ribe, M., (2004), Swedish re-consideration of user cost approaches to owner occupied housing. *Statistical Journal of the United Nations ECE 21 (2004), 139-146*.
- Statistics Iceland, (2004), Changes in the calculation of owner occupied housing in the CPI in August 2004, Statistics Iceland press release, August 2004.
- Statistics Iceland, (2005a), Consumer price index April 2004-2005, *Statistical Series, Hagtíðindi, 2005:2, 3 May 2005*.

- Statistics Iceland, (2005b), Changes of the Consumer Price Index in May 2005, Statistics Iceland press release, 3 May 2005.
- Steiner, P., (1961), Consumer Durables in an Index of Consumer Prices, *Staff Paper no. 6 in The Price Statistics of the Federal Government*,. New York: National Bureau of Economic Research, General series no. 73.
- Triplett, J. E., (2001), Should the Cost-of-Living Index Provide the Conceptual Framework for a Consumer Price Index?, *The Economic Journal* 111 (June), F311-F334.
- Verbrugge, R., (2004), The puzzling divergence of aggregate rents and user cost, 1978-2001. Paper presented at the SSHRC International Conference on Index Number Theory and the Measurement of Prices and Productivity, Vancouver, Canada; June 30 - July 3, 2004.
- Weeken, O., (2004), Asset pricing and the housing market. *Bank of England Quarterly Bulletin*: spring 2004, 32-41.