

Simple User Cost and Rentals

Eight meeting of the International Working Group on Price Indices
(The Ottawa Group),
Helsinki, Finland, 23-25 August 2004

Rósmundur Guðnason
Statistics Iceland
Borgartúni 21a
IS - Reykjavík 150, Iceland
rosmundur.gudnason@stative.is
Preconference version, 15 August 2004¹

Abstract

This paper describes and 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 inverse geometric rate. The prices are measured by a total house price index.

Usually there is a problem in that connection because of the price divergence between rental markets and changes in house prices although that is not the case in Iceland. The price change in rental markets and house markets do not necessarily have to move in similar fashion. This problem is relevant for every user cost method and the use of the rental equivalence method.

Key words

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

JEL Classification

C43, C81, D11, E31.

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

1. Market price approach and simple user cost

1.1 Market price approach to owner occupied housing

Using market prices to measure the price change of owner occupied housing is common for two methods that use different approach in estimating the weights share of housing in the CPI. One is based on the flow of services measurement (covering rental equivalence or user cost) and the other is net acquisition where the housing is capitalized as a net cost.

Housing weight for these two methods differs. In the case of the flow of service measurement where rental equivalence is used some countries use information from the National Accounts and other use information collected by the house owner that is asked what rent, in his opinion, he would get for his house, if he rented it out. For simple user cost the annuity (imputed rent) of the average property value, with long term real interest rate and depreciation is used for estimating the expenditure share. Capitalizing the new house is the weight for net acquisition.

Price are measured in these cases by the change in market prices. In the case of rental equivalence it is the market price of rents for comparable housing. In the case of simple user cost it is the market price change of all properties sold independent of whether they are old or new. By the net method it would theoretically be the market price change of new houses that would be used for price measurement. The price measurement is therefore similar and in all cases based on market prices independent of the method of aggregation of weights. It could furthermore be the case that prices for old and new houses moved in similar fashion over time the house price inflation would then be the same for both user cost and net acquisition but if there are differences in weight shares the effect on the total index would differ. Therefore the same index for all properties sold could be used both for net acquisition as for the simple user cost.

According to this market prices are very important element for all methods and the development of reliable price indices of market prices both for rents and houses one of the main issues in the question of owner occupied housing.

1.2 Simple user cost

In the years 2000-2002 about 81 per cent of Icelanders lived in own housing according to the yearly Households Expenditure Survey. Rental equivalence can therefore not be used in Iceland because of the thin and underdeveloped rental market, where the composition of the owner occupied housing stock and the rental market housing is very dissimilar. The only method available to measure the use of the house for living in it is therefore simple user cost.

House is a place to live in and at the same time an investment and to price measure the use is a difficult problem in CPI calculation. 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.

Converting a part of investment of a durable (such as a house) into flow of service is done by taking into consideration long term financial (opportunity) cost and the use of the capital (depreciation). The method used is user cost and it combines measure of use of capital and the use of the durable itself, calculated for the duration of year, month or some other time interval. The method to calculate housing as simple user cost² and price update the results by the price changes of all properties sold was adopted in November 1992³. In the beginning the price measurement was only conducted in the capital area but since March 2000 it was extended to cover the whole country⁴. The base for the calculation is the real estate value of the house (as estimated by the Land Registry) and that information is collected in the yearly Household Expenditure Survey for each household participating.

The user cost is divided into two parts the structure and land but in but is in the model calculated in one figure, with real interest rate that is now approximately 4% and depreciation rate of 1.25% of the house's real estate value. The value of the house is price updated monthly by price index for all properties sold. Owner occupied housing measured in this way covers imputed rent, minor repairs and other cost, such as tariffs for sewerage, garbage and water.

² This terminology is due to Diewert (2002) 621 and (2003b) 28 and 53.

³ Similar user cost method was used in Iceland from 1980 to measure the profitability of the fishing fleet under high inflationary situation.

The value of the house is collected in the Household Expenditure Survey and is calculated monthly by the simple user cost method.

The simple user cost is calculated in two parts. One is the calculation of 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 annuity⁵. An annuity is a “sequence of equal payments made at equal intervals of time”⁶. In the index calculation the property value is calculated as an annuity and includes both the real interest rate and depreciation. The annuity formula is of the general form:

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

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 converted to years)⁷. 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 is calculated from the same base and increases in the same way by the property index. In addition the rent amount is also calculated over the lifetime of the durable. Lower lifetime of the durable (higher depreciation) leads to lower influence of interest rate changes.

1.2.1 Real interest rate

Nominal interest rates reflect inflation, the higher the inflation, is the higher the interest rates get. This fact that a part of the price of using the capital is due to other factors than the service

⁴ Correction was made for over estimation of price change of houses in April 2000 lowering the CPI by 0.35 per cent. At the same time under estimation of rent was corrected leading to a 0.34 per cent increase in the CPI.

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

⁶ Ayres (1963) 80.

⁷ The lifetime is calculated as 80 years. The depreciation is 1.25% and there is no scrap value the lifetime is, $1/1.25=80$).

price for the use of money makes a use of those rates a quality adjustment issue. The quality issue in this case is inflation that is embedded in the interest rates and distorts the interest value making it a quality adjustment necessary. The real interest rate from this point of view, the quality adjusted nominal interest rate. The quality adjustment is necessary as is the case of every good and service that has a better or worse quality reflected in its price. The real interest rate can be preset as is the case in Iceland and the inflation measured by adding to a real rate the change in the CPI each month⁸.

There is a method available for this kind of correction due to the connection between nominal and real interest rate as expressed by Fisher (1896) identity⁹. 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:

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

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

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

There could be a problem in connection with this in the case of short term movements there are indications that the Fischer effect is not very strong in the short term even if it is so in the longer run¹⁰. If this is right the use of this method should be extended to some kind of average over a longer period of time.

The long term real interest rate used in the simple user cost model calculation 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. Methods that measure user cost and do not use a quality adjusted interest rates and in addition take into account all short term

⁸ Indexation of this kind in Iceland refers only to mortgages for a period of five years or longer.

⁹ Diewert (2003a) 21

¹⁰ Mishkin (1992)

movement in house prices will be exaggerating the price changes and not taking into consideration the development of the prices over the lifetime of the durable. The results will therefore also be very volatile¹¹.

The real interest rates used are nearly fixed but their variable part should reflect in some way the long term trend in the real interest rates and that is why a part of them are kept variable. When setting the average long term real interest rate in the model two main types of financing are viewed. The part that the buyer has to finance by loan and also the required return of his own equity. When consumers buy properties they finance it partly with own equity and partly with mortgages. In the simple user cost model the division between these two forms of finance forms are based on information from the sales contracts used for the house price measurement. The own equity rate is fixed in the calculation but the mortgage real interest part is variable. The opportunity financial cost covering the lifetime of the durable is measured in this way.

These shares of finance are used to calculate the real interest rate used in the model. Part of the price of the house is paid by cash and that is approximated as the buyers own equity¹² and is covering more than half of the price given for the house. The real interest rate is of a long term character and is similar to long term real rates used to evaluate the assets of pensions funds. The rate for own equity was therefore set as the estimated rate of return for the pension funds in Iceland and are kept fixed over the durables lifetime. When this calculation method was adopted the long time real interest rate of the pension funds was estimated as 3 per cent and it has been kept unchanged since then¹³. Other long-term real interest rates used are variable over time. These other forms of payment are usually new or old mortgages. The real interest rates used are in the range of 5.0% to nearly 9.0%. These mortgages are mainly from the Housing Fond or old loans from the old State Housing Board. Other financing is mainly originating from the pensions funds or the banks. The largest share of these loans have fixed real interest rates that have been unchanged for the period of this method's lifetime. Hence, the variability of the long term variable real interest rate has been relatively small over time.

¹¹ Gillingham (1983), Johannessen (2004) and Verbrugge (2004).

¹² This share can partly be financed with loans.

¹³ The long time rate of return for the pensions funds is now in the range of 2.0-3.5 per cent. Long time rate of return according to the liability law is 3.5 per cent.

The average real interest rate measured monthly in this way has been around 4% since 1992. The interest rates of the House Fond mortgages have been relatively stable over the last years. In July 2004 this changed and these rates are now set monthly and will probably fluctuate more than before. This led to a change of method going over to a moving five year average for these rates. The motivation was formulated in this way in the press release published on 12 August 2004. "This practice should ensure that the short term changes in the real interest rates of housing mortgages will not cause significant volatility in the monthly measurement of the CPI. On the other hand, it also secures that long term changes in the real interest rates are taken into consideration". The full text of the press release is found in Appendix 1.

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:

$$(5) \quad A_{HV} = P_H * \left[\frac{r}{1 - (1+r)^{-N}} \right]$$

According to formula (5) the real interest rate has a direct influence on the annuity and an increase in the average real interest rate, when the rate is 4% and the lifetime is long (80 years) the annuity (imputed rent) increases by almost the same amount as r . The user cost is therefore very vulnerable to real interest rate changes.

The real interest rate has also influence on the value of the property used as the base for calculating the annuity (rent) as lower interest rates 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.

1.2.2 Depreciation

It is difficult to measure depreciation that should reflect the tear and wear of property and that measurement is always very uncertain. There are generally three methods used to obtain the rate at which structures depreciate. The first method is to observe the age by making a rough estimate of the life of the durable “and then by assuming depreciation model that seems most appropriate”¹⁴. The second method is to use cross sectional information to set the depreciation rate and the third method is to use information on rental or leasing prices. In deciding the depreciation rate used in the simple user cost calculation the first method was used. “The first and simplest method is to impose a particular depreciation pattern on the average observed life of structures to derive a depreciation rate”¹⁵.

The depreciation rate used in the user cost calculation was arrived at mainly by viewing the age of the housing stock. According to the Real Estate Registry the stock at the end of the year 2001¹⁶, divided after the building year, show that 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 the property stock divided after age or building year.

The user cost covers both the property structure and the land it is built on. The depreciation for the property is 1.5 per cent setting the life time of the property to approximately 67 years. Land does not wear over time and is therefore not depreciated. The depreciation is calculated of the value of the building. In the price information used to calculate the house price index the price of land is never separated¹⁷. It is therefore convenient to calculate the depreciation of the whole value of the housing stock, both structure and land. The depreciation rate used in the index is 1.25 per cent of the real estate value.

¹⁴ Diewert (2003b) 23.

¹⁵ Malpezzi, Ozanne and Thibodeau (1987) 373.

¹⁶ Örn Ingvarsson (2002) 261.

¹⁷ Statistics Iceland has under consideration to calculate separately user cost from structure and land.

There are three depreciation methods most common. Straight line depreciation when the depreciation is divided into equal shares, one hoss shay or light bulb depreciation when the durable is depreciated until it falls apart and 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 geometric form in the annuity formula is a inverted geometric depreciation of the type $(1 - \delta)^{-N}$. The depreciation calculated in this way differs therefore from the usual geometric depreciation in that it is small in the beginning but increases as the years go on¹⁸. In addition the durable is fully depreciated which is not the case with the usual geometric depreciation.

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 the lifetime of the durable.

2. Rentals and property prices in the consumer price index

Sometimes big increase in house prices are taken as a token that a bubble like behaviour of the market could be at hand which could lead to sudden fall in house prices. One of the things often looked at in that connection is the change in house prices against the price increase of rents. A strong connection can be observed between price changes in the rent market in Iceland and the changes in the market prices of housing, i.e. both indices seem to develop in similar way in the longer run even though they in shorter time periods can move in dissimilar cycles. Imputed and actual rent showed similar changes from March 1997 until November

¹⁸ The depreciation measured as the amortization of the principal, 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 deprecation amount is larger than the interest.

2003¹⁹. Because of the small size of the Icelandic rent market it can be said that the house prices lead the rent market.

The rent and property market can move in dissimilar fashion. That could point to imbalances between these two indicators which need not be the case. One reason being regulation or controlling of rent and another could be a quality adjustment issue.

There will also always be difference between the level of market rents and imputed rents.

When the rent is set the landlord has to take into consideration the cost incurred²⁰ such as transaction cost that can be considerable²¹. There is also a quality issue connected to this as owner can adjust their home in any fashion they like unlike tenants that are not allowed to do that.

3. Measurement of property prices

3.1 Real estate value of the property

The Land Registry of Iceland calculates a real estate value for every property in the country. In the middle of the year 2001 the Land Registry revised the estimation method by using hedonic regression after extensive research. The base for the analysis was the capital area and the estimates for other parts of the country were calculated with regional coefficients²².

The value of all properties in the country are measured in a harmonised way based on information about sold properties. This is done with reference to 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”²³. This basic information is the same as used in the price measurement of housing in the CPI and the real estate value is therefore well suited as a base for the user cost calculation.

¹⁹ The increase in housing prices from March 1997 to November 2003 is nearly 77.9 per cent and the rent index rose in the same period by 78.2 per cent. At the same time the total CPI rose by 28.5 per cent and CPI less housing cost by 22.7 per cent. The CPI is therefore 4.8 per cent higher than the CPI less housing cost in this time interval.

²⁰ Diewert (2003b) 46-48.

²¹ Economist (2003) 7.

²² Fasteignamat Ríkisins (2002) 17-22 and Örn Ingvarsson (2002) 259-270.

3.2 Measurement of property prices

Sales contracts are the base for the calculation of the index of property prices. One of the main reasons for using them is the fact that the contracts are standardised for the whole country. Each contract contains information about the property and owners, the sales amount and complete information about the form of payment. Each property has a standardised identity number that is used in the property database that the Land Registry maintains. This very detailed information is the foundation for the valuation of property sales.

The sales information is collected through the Official Registry of Deeds. The formal registry of the change of the ownership is done by the Land Registry and for that the sales contract has to be at hand. Between 8-10 thousand sales contracts are collected each year covering 8-10% of all properties in the country²⁴.

The Land Registry of Iceland has collected the sales contracts over a long period of time. The market prices of properties that are gathered from the sales contracts are used by the Land Registry as the base for their evaluation of all house's real estate value. This information is also used in the calculation of the simple user cost in the CPI.

The price concept used in the CPI is cash price. In housing there are different forms of payments used so the price evaluation is more complex. The reason is the fact that there are different forms of payments when a house is bought. As money received today is not the same as money received at another time in the future there is a need to calculate the present value of each contract.

The discount rates varies after the type of payment in accordance with market information. The discounting rate of return is measured monthly and if the change exceed a certain minimum the rate of return is changed. Housing Bonds have the biggest share in housing financing but will be replaced from July 2004 by ÍLS mortgages.

²³ Örn Ingvarsson (2002) 260.

²⁴ It does not matter whether the number of sales or values are used.

When the discounting rate is lowered, the present value of the property increases. An increase in the discounting rate of return lowers the present value of the property. This is in accordance with the market influence of lower mortgage rates that lead to higher property prices and in the same way as higher mortgage rates lead to lower house prices.

Changes in the market prices and the discounting 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 for the property. In the long run the nominal and cash house price follow each other but within shorter interval they can part temporarily²⁵.

3.3 Price index for housing

The house price index is calculated based on the change in the present value of property prices as measured in the sale contracts. The total price information from all the sales contracts are used for the calculation of imputed rent. The prices used are the average prices for the whole country²⁶. In the calculation the combination of the house's size in square meters is kept fixed. The weight is based on the sale's volume in four size categories as it was in the last three years. The calculation is based on three month's moving average with one month's time lag²⁷. The sales contracts in April refer to the period January to March and in May for the period February to April e.t.c.. The main indices are four, for houses and apartments inside and outside the capital area. The price change is measured for following type of housing. Houses (13 per cent share) and apartments (59), for the capital area (total 72), houses (15) and apartments (13) outside the capital area (28). The emphasis is on the price change within groups of properties not between types of properties or between regions and the quantity weight between regions is kept constant.

²⁵ From november 2003 to November 2003 house prices in the CPI rose by 11.9 per cent. Nearly half of that change is due to the change in cash prices over nominal prices due to the discounting.

²⁶ This has been in this way since March 2000. The index for the whole country was then calculated back to March 1997.

²⁷ Contracts from places outside the capital area arrive with two months timelag.

Appendix 1

Text of a Statistics Iceland press release, 12 August 2004

Changes in the calculation of owner occupied housing in the CPI in August 2004

The calculation of owner occupied housing in the Icelandic CPI is based on one hand on changes in the market prices of sold properties and on the other hand on the assumed lifetime of the properties (depreciation) and the long time real interest rate (opportunity cost) of the investment in housing

The composition of the real interest rates in the calculation model that Statistics Iceland uses is based on information obtained from sales contracts collected by the Land Registry of Iceland. Approximately two third of the rates do not change from month to month as these are rates on the owners own equity and on old mortgages. In the category “other interest rates” the real rates for mortgages from the Housing Fund form the largest category and they have been relatively stable over the last ten years.

The lending by the Housing Fund was changed in July 2004 by introduction of loans in cash, ÍLS mortgages, that replaced the former housing certificates and bear lower real interest rates. In the calculation of the CPI in July, Statistics Iceland did take into account the lowering of the interest rates of the housing loans as it leads to the lowering of the level of real interest rates. This is in accordance with the practice adopted when similar real rate changes occurred previously, for example at the end of 1993 when the mortgage rates were lowered from 6% to 5% and in the beginning of the year 1995 when they rose from 5% to 5.1

In the new lending system, the real interest rates are set each month. For CPI purposes, this could be a challenge to the stability of the real interest rates used in the calculation of the user cost. The long time real interest rates used in the calculation are set in accordance with the lifetime of the house and it would therefore not be appropriate if short term changes in the real interest rates would have major influence on the monthly price measurement. Because of this, it is necessary to extend the model level of real interest rates over a longer period of time.

Statistics Iceland has decided that as of August 2004 the real interest rates used will be calculated as a five year moving average. Initially, the average will be calculated for the period from March 2000 but at that time the house price index was extended to cover the whole country instead of the capital region covered previously. Hence, the first calculation will cover 54 months. The rates will be changed each month and added to the average till they have reached 60 months in February 2005. In each month after that one month will be taken away and a new one added. This practice should ensure that the short term changes in the real interest rates of housing mortgages will not cause significant volatility in the monthly measurement of the CPI. On the other hand, it also secures that long term changes in the real interest rates are taken into consideration.

References

Ayres, Frank, JR. (1963), *Mathematics of Finance, Schaum's Outline Series, McGraw Hill Book Company*, May 1963.

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

Central Statistical Office, (1994), *Treatment of owner occupiers housing index in the retail price index, Retail Price Index Advisory Committee*, December 1994.

Diewert, W. Ervin, (1998), *Index Number Issues in the Consumer Price Index*, 47-58, *Journal of Economic Perspectives* 12/1,

Diewert, W. Ervin, (1999), *The Consumer Price Index and Index Number Purpose*, *Journal of Economic and Social Measurement*, 27 (2001) 167-248.

Diewert, W. Ervin, (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. Ervin (2002), *Harmonized Index of Consumer Prices: Their Conceptual Foundations*, *Swiss Journal of Economics and Statistics* 138:4, 547-637.

Diewert, W. Ervin, (2003a), *Measuring Capital*, *NBER Working Paper w9526*, Cambridge MA:NBER.

Diewert, W. Ervin, (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.

Economist, (2003), *House of cards*, *May 31st 2003*, 3-16.

Fasteignamat Ríkisins (2002), *Árbók 2002*, Fasteignamat Ríkisins 2002 Land Registry of Iceland, Yearbook 2002, (in Icelandic).

Gillingham, Robert (1980), Estimating the user cost of owner occupied housing. *Monthly Labour Review* 1980/February.

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

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

Guðnason, Rósmundur (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, Rósmundur (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.

The Housing Financing Fund (2003), Process in housing financing, Available at the website: http://ibudalanasjodur.is/displayer.asp?cat_id=15

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

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

Johannessen, Randi (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, Dale W., (1967), the Theory of Investment Behaviour, in *Determinants of Investment Behaviour*, edited by Robert Ferber, National Bureau Of Economic Research, New York.

Jörgenson, Dale W., (1996), Empirical Studies of Depreciation, *Economic Inquiry* 34, 24-42.

Mishkin, Fredric 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.

Malpezzi S., Ozanne L., Thibodeau T.G., (1987), Microeconomic Estimates of Housing Depreciation, *Land Economics*: Nov 1987; 63,372-385.

Muth, Richard F., (1972), On the Measurement of Shelter Cost for Homeowners in the Consumer Price Index, *Bureau of Labour Statistics*, mimeograph, 1972.

Muth, Richard F., (1975), The User Cost of Owner-Occupied Housing, *Bureau of Labour Statistics*, mimeograph, 1975.

Smith, Dale A., (1975), The Flow of Services Approach to Estimating the Homeownership Component of the CPI, *Bureau of Labour Statistics*, mimeograph, 1975.

Steiner, Peter, (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, Jack. 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, Randall (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

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