Owner occupied housing in the Icelandic CPI, a survey of simple user cost for a quarter of a century.

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Abstract

For a quarter of a century owner occupied housing in Iceland has been compiled as a simple user cost in a very volatile period in Icelandic economic history. In this context, question arises of the suitability of the method used. This paper surveys the methods used in the compilation for owner occupied housing in Iceland and evaluates the results. First methods used in the calculation of housing in the CPI from 1924 till today are surveyed. Then the simple user cost method is described and compared with methods used by other countries for compilation of OOH in their CPI. The results of the calculation of OOH over the 25 years period are analysed and compared with different domestic economic indicators. At last a comparison is made between the simple user cost method used in Iceland and the user cost methods used by Sweden and Canada and a simulation of the Swedish user cost method conducted with Icelandic data set and the results analysed.

Key words:

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

JEL: C43, C81, D11, E31

1. The calculation of housing in the Icelandic CPI from 1914 to present[1].

In 1922 there was a demand for an indicator of cost of living for the purpose of indexing wages. In 1915 Statistics Iceland started collecting at a quarterly interval prices of daily necessities in 40 outlets for 61 items. These items were not weighted by their importance for consumption nor was there a household expenditure survey to map consumption. In 1922 the director of Statistics Iceland attempted to make a base for cost of living index derived from the expenditures of his own family. The weighted Icelandic CPI was calculated for first time in 1922 based on estimated weights. The main problem was the calculation of housing and as most people lived in rented housing the problem was described as follows:

> "The housing has been the most difficult subject. Admittedly, there are reports available that were collected with the census on 1st December 1920." "Under normal circumstances, it can be assumed that the building cost of houses is the dominating factor in deciding the rent" (Þorsteinsson Þ. (1923), page 17 and 18)

The weight for housing was assessed from estimated rental costs. However, it was assumed that rent would not be entirely based on construction costs and that the price increase is "based on more guesswork than on the other items" (Þorsteinsson Þ. (1923), page 19). The base of the index is therefore an evaluation of estimated rent and price updated with estimated construction costs. In 1939 the result from 1922-1930 were recalculated based on information from the census 1930 which showed that rent had risen much more than calculated results (by almost 60 per cent). The index was therefore adjusted backwards to 1923 and the price increase incorporated was 2.6 per cent.

The period from 1922-1939 was characterised by deflation. In the period 1914-1924 the CPI rose by nearly 221 per cent and the housing component rose by 231 per cent.

In the period 1924-1939, which was a period of deflation, the level of the CPI fell by nearly 16 per cent yet the housing component rose by more than 51 per cent in the same period. In 1914 the expenditure share of housing was 17.2 per cent, however by 1939 the share had risen to 32.1 per cent.

[1] The author would like to thank Heiðrún Erika Guðmundsdóttir and Ólafur Hjálmarsson for assistance in the preparation of this paper.

Table 1. Price changes for different bases of the Icelandic CPI from 1914
CPI less housing cost, housing and the building cost index (BCI)

Years	CPI	CPI less housing	Housing	BCI
1914-1924	221%	219%	231%	226%
1924-1939	-16%	-29%	51%	-6%
1939-1959	673%	890%	175%	1189%
1959-1968	116%	150%	51%	159%
1968-1984	12777%	14617%	6085%	13474%
1984-1988	145%	148%	124%	124%
1988-1992	61%	64%	44%	71%
1992-1997	11%	11%	-4%	16%
1997-2019	162%	119%	415%	227%

It was stipulated by law in 1939 that a household expenditure survey should be conducted under the supervision of the Consumer Price Index Board (CPIB). The CPIB should decide the results but Statistics Iceland should compile the index and gather the data and compile the results. The members of the board where appointed by a confederation of labour unions, a confederation of employers and the government. At this time wages were regulated by price changes in CPI. In 1939 the first household expenditure survey was conducted and applied as of the first quarter that year. It was based on expenditures of 40 workers' families.

> "After this, government and parliament intervention of the index became more common as its use for indexing wages and benefits increased." (Þorsteinsson (1964), pp. 42)

From the beginning of the 1922 until 1984 the CPI index weights for housing were estimated according to the rent that households payed although changes in market rent prices were not used in the compilation. The indexes were mostly based on estimation of building costs or maintenance costs. In 1950 the index weight for rent was adjusted upwards but the price measurement was not changed. Rent control was established in 1941 stipulating that price changes were limited to maintenance and limited to 15 per cent. The price change of housing was calculated in line with this until 1959 even though the law expired in 1953.

In the period 1939-1959 the housing component rose by 175 per cent, the CPI less housing rose by 890 per cent and building cost index rose by 1189 per cent. In the following period, up to 1984, the price changes of housing were considerably lower than other indicators suggesting that the methods used did not reflect the price change.

In the period from 1968-1984 inflation was very high measured by all indicators and in 1979 indexation of financial obligations was introduced by law as to secure savings and to restore the loan market. In 1983 indexing wages was abolished and the role of the Consumer Price Index Board became emblematic and advisory. The aim of the index also changed, moving away from indexing wages in to a more general price indicator.

The household expenditure surveys from 1939-1984 were all based on families with children. The first survey to consider all households was the 1978/79 survey that was used for the 1984 base in the CPI. As of the 1984 base, taxes were excluded again, whereas they had been included since 1969 as in a previous period of 1914-1939. In 1984 more people lived in their own accommodation, which led to housing weights being estimated instead of relying on rent expenditures. It was decided that the weight should be based on expenditures on houses including payment of interest. The price change was estimated from 1984-1988 by using the building cost index. The weights in the 1988 CPI base used interest rates and other costs measured in the household expenditure survey. In 1988 there was a change in the calculation methods as payments were used for measuring the price change and nominal rates used and the price compensation part of the loan.

In the period from 1914-1992 the price change for housing was always lower than for other indicators meaning that CPI less housing and building cost index were always measuring higher price changes.

In 1992 it was decided to calculate owner occupied housing as user cost for estimating rental equivalence. The aim was to use a flow of services method in line with the national accounts. The user cost method covered both the rental market as well as owner occupied housing. The change was incorporated in November 1992 and described in the following way

> "As the majority of the Icelandic people live in their own housing and the rental market is very small, it was decided to calculate the housing component of the index as rental equivalence in accordance with national accounts methods when it comes to own housing" (Statistical Series (1992), p. 486).

In March 1997 a separate index was calculated for market rent as better information was available about the rental market. Since then housing has been calculated for both parts for those living in own housing and tenants.

The frame of the CPI was better defined by law in 1995 (act no. 12/1995) on the consumer price index. The law in 1995 was set in parallel with the decision to index financial obligations, i.e. housing loans, retirement savings etc., by the consumer price index. In this act the role of the index is defined to show changes in private consumption and in that way the frame of the index is by definition in line with the national accounts.

In the years 1997-2018 CPI less housing increased less than the CPI reflecting high increase in housing cost as rental prices and imputed rent increased considerably. This was a turbulent time as inflation in the world went down, the exchange rate of the Króna (Icelandic currency, ISK) changed considerably, a period which ended with banking crashes and the first steps taken to restore the economic situation.

2. User cost, housing and other domestic indicators for 25 years

Rental and housing markets are in theory two sides on the same coin and should therefore move in a similar fashion. That is not necessarily the case as the composition of the durable stock can differ and there are costs in the rental market that those living in own housing do not face and should therefore not be included in the owners cost.

The efficiency of the simple user cost method can be tested by comparing the price changes of market rent and imputed rent as they should move in similar fashion over time.

Table 2 Rent and imputed rent indexes 1994-2018.
March 1997=100

Year	Rent	Imputed rent
Average logaritmic change		
1997-2018	8,0%	8,1%
2001-2018	7,5%	7,6%
2007-2018	6,6%	5,0%
Average monthly logaritmic change		
1997-2018	0,64%	0,65%
2001-2018	0,61%	0,61%
2007-2018	0,53%	0,40%

In the period 1997-2018 the average monthly rent and imputed rent moved in similar fashion. In the period 2007-2018 prices in the market rent increased yearly by 8 per cent (0.64 per cent monthly) and imputed rent by 8.1 per cent (0.65 pcm). The price change in the years 2007-2018 were 6.6 per cent (0.53 pcm) for market rent and 5 per cent (0.40 pcm) for imputed rent. The market rent and imputed rent are therefore moving in similar fashion. Although they move in similar fashion on average the changes between years can differ but they always move in line from 1997-2018.

The period 1997 till 2004 they moved in similar fashion and the ratio of imputed rent to rent is around one. Rent increased more than imputed rent in the years 2001 to 2003. From 2003 this has changed and in the period 2004 to 2005 housing prices rose by nearly 29%. When the effect of lower real interest rate was accounted for the increase in the imputed rent in the same period was nearly 22 per cent. In 2007-2008 there were similar changes in both market and imputed rent.

Table 3. Rent and imputed rent 1997-2017, March 1997=100

	Rent	Imputed rent	Rent Per cent	Imputed rent Per cent	Imp/rent Per cent	Imp/rent Ratio
1997	100,0	100,0				
1998	112,7	107,4	12,7%	7,4%	-4,7%	0,9530
1999	116,8	120,9	3,7%	12,6%	8,6%	1,0350
2000	134,7	139,0	15,2%	14,9%	-0,3%	1,0321
2001	146,8	147,8	9,0%	6,4%	-2,5%	1,0068
2002	159,5	154,9	8,7%	4,8%	-3,5%	0,9713
2003	175,4	172,0	9,9%	11,0%	1,0%	0,9808
2004	189,2	187,6	7,9%	9,1%	1,1%	0,9914
2005	201,0	228,7	6,2%	21,9%	14,8%	1,1378
2006	217,6	266,2	8,3%	16,4%	7,5%	1,2230
2007	250,6	302,7	15,2%	13,7%	-1,2%	1,2078
2008	281,6	339,8	12,4%	12,3%	-0,1%	1,2066
2009	325,5	305,8	15,6%	-10,0%	-22,1%	0,9396
2010	336,0	287,0	3,2%	-6,1%	-9,1%	0,8542
2011	352,6	295,5	4,9%	3,0%	-1,9%	0,8382
2012	372,9	304,5	5,8%	3,0%	-2,6%	0,8165
2013	400,5	312,8	7,4%	2,7%	-4,3%	0,7811
2014	426,1	337,4	6,4%	7,9%	1,4%	0,7920
2015	442,8	365,1	3,9%	8,2%	4,1%	0,8246
2016	461,9	399,6	4,3%	9,4%	4,9%	0,8651
2017	479,6	477,1	3,8%	19,4%	15,0%	0,9948
2018	504,1	515,0	5,1%	7,9%	2,7%	1,0218

After the bank crash in 2008 market rent lowered by 22.1 per cent more than imputed rent. This was the case to 2014. In 2017 there was again increase in imputed rent by 19.4 per cent the difference in relation to imputed rent being 15 per cent. The reason for this was increase in real wages, higher demand because of increase in tourism and immigration all leading to increased demand for properties. The share of imputed rent to rent went to 1.02 in 2018.

CPI increased on the average by 4.1 per cent (0.33 on average monthly) in the period 1993-2018 and the CPI less housing by 3.3 per cent (0.39). The rate of change increased in the period 2007-2018, CPI 4.7 and CPI less housing 4.2.

Wage and building cost indexes rose more steeply than the CPI. The average yearly change in the wage index in the period 1993-2018 is 6.6 per cent (0.54) and for the building cost index 5.3 per cent (0.43).

Table 4 Main indexes 1994-2018, March 1997=100

Year	CPI	CPI less housing	Wage index	Building cost index
Average logaritmic change, per cent				
1993-2018	4,1%	3,3%	6,6%	5,3%
1997-2018	4,5%	3,6%	7,1%	5,6%
2001-2018	4,6%	3,7%	6,9%	6,0%
2007-2018	4,7%	4,2%	6,8%	5,9%
Average monthly logaritmic change, per cent				
1993-2018	0,33%	0,27%	0,54%	0,43%
1997-2018	0,37%	0,30%	0,57%	0,45%
2001-2018	0,37%	0,30%	0,56%	0,49%
2007-2018	0,39%	0,35%	0,55%	0,48%

The CPI increases counter cyclical to CPI less housing. The exchange rate effect the changes in CPI less housing as approximately one third of expenditures are imported goods. Owner occupied housing is not influenced by these factors but by the prices of properties through market rent and imputed rent. These changes balance each other out. This is a very important characteristic of the Icelandic CPI.

Data on the yearly changes of main indexes is found in Appendix 1

Table 5	Real property prices, deflated by March 1997=100		
	CPI	Wage index	Building cost index
Average logaritmic change			
1997-2018	3,9%	1,4%	2,8%
2001-2018	3,6%	1,3%	2,2%
2007-2018	0,9%	-1,0%	-0,2%
Average monthly logaritmic change			
1997-2018	0,32%	0,11%	0,23%
2001-2018	0,29%	0,11%	0,18%
2007-2018	0,07%	-0,09%	-0,02%

The property prices in nominal value influence the calculation of housing. To show the real price change three domestic indicators are used; CPI, wage index and the building cost index. In real terms the average real price change in 1997-2018 lies in the interval 1.4-3.9 per cent per year. For the period 2007-2018 the real prices are around zero meaning that they have not reached the pre bank crisis level.

Data on the yearly changes for real property prices is found in Appendix 2

3. Description of user cost in Iceland Sweden and Canada.

The calculation of own housing is described but treatment of other housing cost is not taken into consideration in this paper.

The Icelandic user cost method

In Iceland, the approach of calculating housing cost as a simple user cost was adopted in November 1992. To begin with price measurements for housing covered only the capital city area; since April 2000, however, they apply to the whole country. 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. Price measurement occurs monthly according to a price index for sold properties and changes in long-term real interest rates. The expenditure weight is the household's annuity, derived by following equation

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

where P_H is the present value of the annuity, r the real interest, N the lifetime (in years) and A_{FM} the base for the annuity.

The entire real estate property of Iceland is valued in a harmonized way through information on the market price of properties sold. The information on which the measurement is based is the same as that used for updating the prices of owner-occupied housing in the consumer price index.

In Iceland, real interest is preset, with the subsequent changes in the consumer price index being added to figure the nominal interest. The long-term real interest used in calculating user cost shows the return on investment during the lifetime of the durable. 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. During computation, the interest on equity is kept fixed, while interest on the borrowed money is variable, in order to estimate the opportunity cost of the capital for the lifetime of the assets. The financing is divided in this way to calculate the real interest rate that is used. The part of the house price paid in cash is considered the buyer's equity. 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 has been left unchanged for these calculations. Interest on borrowed money is changed monthly using twelve months moving average from one month to the next. On the other hand, it is certain that developments in the real interest rate are reflected in price measurements of housing over the long term.

The depreciation rate was determined chiefly by reference to the construction year of the property base. 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 Swedish user cost method[2]

The base weight for small houses is the total capital invested in each property calculated by the historical price in accordance with the length of ownership. Renovations are taken into account but not new houses. In the calculation of historical prices for houses property price capital index is used along with the taxation value of the property. It is calculated for all houses taking the time length of the ownership by the same person into account. The base for housing cooperative is historical average prices by the length of the ownership calculated in accordance with a property price index for all housing cooperatives sold.

The base expenditure share is in line with the historic buying prices and calculating by multiplying average estimated buying price for small houses by the total number of houses (now approximately 1.8 million). The method used for the housing cooperatives is multiplying the average buying price that is available with the total number of housing cooperatives (now approximately 1 million). In the calculation a 30% tax reduction available for most owners is subtracted.

In each index link the stock available cover all historical buying prices with 2 years delay. The interest rate used is the average nominal interest rate on loans available to by small houses for the same period. The base weight for small houses and housing cooperatives is calculated by applying the average interest rate to the historical buying prices for the total housing stock in the base period. In the calculation of the monthly interest rate, the base period interest weight is calculated by the product of the capital stock index and the interest rate index.

The capital stock index consists of two parts, property price index and the stock stratified by the time of ownership for all small houses and housing cooperatives as it was two years ago. The property price index for houses is published quarterly and for housing cooperatives monthly. The capital stock index is calculated covering the stock of small houses and housing cooperatives stratified by the time of ownership and price updated by a property price index monthly by using a moving average probably for 25-30 years. The calculation of

[2] The author would like to thank Emanuel Carlsson and Martin Ribe for thorough introduction to the Swedish user cost method at Statistics Sweden on June 18. 2018.

the interest rate index a monthly interest rate is used that is collected from financial statistics compiled by Statistics Sweden in accordance with outstanding loans as they measure it, most common interest rate being three months variable rates.

The base weight for depreciation of houses is based on tax value of the stock estimated by a property price index to prices in December each year and the depreciation calculated as 1.4% of this stock. In each month the weight share is price updated by a maintenance index that is a mix of material and labour components. Depreciation for housing cooperatives is calculated in a similar fashion.

The Canadian user cost method

Statistic Canada describes its method for calculating mortgage interest in the following way.

„The mortgage interest cost index estimates the impact of price changes on the amount of mortgage interest owed by the target population on its mortgage balance. It is the product of two components: a component estimating the impact of changing house prices and another measuring the impact of changes in interest rates. When house prices increase, the amount of the loan required tofinance the purchase of a dwelling increases, which results in a corresponding increase in the interest cost, provided that the interest rate is constant. On the other hand, an increase in mortgage interest rates, mortgage balance remaining constant, also results in an increase in the interest amount owed. The price associated with a mortgage balance is the average house price in the month of acquisition of the residence. The interest rate corresponds to the period when the loan was initiated or renegotiated. The interest owed on a stock of mortgages during the current month is therefore not only a function of house prices and interest rates in the current month, but also those for the previous months, aggregated according to the shares of new and existing mortgages. Since the total value of houses purchased during a given period is always a small proportion of the total stock of dwellings, the total amount of mortgage interest owed each month continues to reflect the impact of past changes in house prices for a very long period. In reality, the house prices that enter into the estimation of the mortgage interest cost for each month represent the weighted average house price of the previous 25 years. The weights reflect the distribution of mortgage balances by mortgage vintage, such that older mortgages have a relatively lower weight. This is because newer mortgages generally have a higher principal owing than older mortgages. Past mortgage interest rates also continue to be reflected in the current month

index, because new interest rates only affect the index through mortgages newly initiated or renegotiated. These are generally a rather small proportion of the stock of existing mortgages."

„Depreciation is not an actual payment, but rather a conceptual expense that must be imputed. It corresponds to the hypothetical amount required to replace the portion of the stock of owned accommodation used each year by the target population. It is derived from data extracted from the Survey of Household Spending. Respondents are asked how much they would expect to receive for their house if they were to sell it. This amount is multiplied by a ''house/property'' ratio to obtain an estimate of the value of the house, excluding the land, to which a depreciation rate of 1.5% is applied. For monthly price movements associated with replacement cost, a version of the New Housing Price Index (NHPI) which excludes price changes associated with the land is used." (Shoumere (2017) p.6)

4. Comparison between user cost methods in Iceland, Sweden and Canada.

These user cost methods used in the CPIs in Iceland, Sweden and Canada all take interest rates and depreciation into account. The methods differ however in what they are meant to achieve and in the choice of interest rates. The Icelandic user cost measures the flow of services method targeting rental equivalence as defined in the national accounts. All prices are present prices.

The Swedish and Canadian user cost methods reflect that the main use of the CPI is for compensation. The prices used are from various time points, which are 12-15 years on average in the past. Hence, property prices in this context are more or less old prices.

Both the Swedish and the Canadian owner occupied housing methods are payment related. The Canadian method is a full payment method using remaining debt of mortgages at the time of measurement as weight. The payment method covers only households that are in debt and excludes households which have none. In this respect the Swedish method differs considerably from the Canadian as all households living in their owned homes are included. The Swedish method however estimates the original buying price back in the time when the homes were bought. The interest is calculated from the whole stock including in that way own equity.

The Icelandic method uses the whole stock and calculates a rate of return on own equity.

All three countries use present time interest rates. The choice of interest rates in Iceland is to use real interest rates, but in Sweden and Canada the choice is to use nominal interest rates. The treatment of depreciation is similar in all three countries. The depreciation is calculated at a similar rate from a stock that is price updated to current prices. The stock in Iceland and Sweden are register based but in Canada estimated by the statistical office. The stock is updated yearly in Iceland but every third year in Sweden. In the property price indexes used in Iceland and Sweden land is included but the index used in Canada excludes land. Depreciation is calculated in Canada and Iceland from the property stock excluding land.

Table 6.	User cost properties in Iceland, Sweden and Canada
	Iceland
Theoretical	National accounts, rental equivalence
Coverage	Simple user cost
Aim	Flow of services, model
Price index	All properties sold, superlative, Fischer
Time period	3 months moving average
Stock	Total stock valued at today prices
Weight	The annuity (present value) of the housing stock
Own equity	Yes
Interest	Real, todays rate
Depreciation	1,5% of property excluding land (1.25% of total)
	Sweden
Theoretical	Compensation
Coverage	Partial user cost
Aim	Payment model, all stock at prices when property was baught
Price index	All single flats, Laspeyre, Housing cooperatives, Hedonic
Time period	25-30 year moving average
Stock	Total stock valued at original buying prices, at the price level 12-15 years ago
Weight	Found by mulitiplying the housing capital stock index by the average interest rate.
Own equity	Yes
Interest	Nominal, todays rate
Depreciation	1,4% of total stock
	Canada
Theoretical	Compensation
Coverage	Partial user cost
Aim	Payment, outstanding mortages
Price index	New building, without land?
Time period	25 years moving average
Stock	Outstanding mortages valued in prices 12-13 years ago
Weight	Outstanding mortages multiplied with average interest rate
Own equity	No
Interest	Nominal, todays rate
Depreciation	1,5% of total stock

5. User cost, Icelandic data applying the Swedish user cost method.

The aim is to simulate the Swedish user cost method in Iceland. The main issues are the nominal and real interest rates and the depreciation. Depreciation is based on the property stock and on a property index or capital stock index.

The first issue is the real interest rate and the nominal interest rate. The real interest rate used is the same as is used in regular compilation of the index. The Icelandic Centralbank publishes on regularly time series for nominal rates that are used in this exercise.

The second issue is the property index used and the average made over time to simulate the capital stock index. In Sweden the sale of properties for small houses are around 3-4 per cent per year approximating a 30 years ownership of a house. To estimate this time interval the sale of properties in Iceland as per cent of the stock is used for the period 2001-2018.

Table 7. Average properties sale as per cent of total stock 2001-2018

	Capital area	Outside capital	Total
Average	8,4%	3,8%	6,6%
Min	2,5%	1,2%	2,1%
Max	14,1%	7,2%	9,6%

The average is 6.6 per cent per year meaning that the average ownership time is 15 year. This ratio is very different over the year and in the time interval the max ratio is 14.1 per cent and the min 1.2 per cent. To calculate the capital stock index the property index used is available from January in the year 1992. The first period used in the capital stock index is January 1992 – January 2007 and the last time interval is December 2003- December 2018.

The third issue is the stock. The average real estate value in December 2006 is used as a base value at the beginning of the simulated capital stock index based on fifteen years moving average used in the calculation. The average real estate value is used both for the calculation of interest and depreciation.

The model is based on monthly values of all the variables from January 1992 to December 2018. They are used to calculate the annuity and to calculate the capital stock index to simulate the Swedish approach.

Table 8. Simulation Swedish user cost model with Icelandic data

	Annuity method Iceland				Simulation Swedish method,				Difference	
	Property index	**Real interest**	**Effect**	**Weight**	**Capital index**	**Nominal interest**	**Effect**	**Weight**	**Effect**	**Weight**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(3)-(7)	(4)-(8)
					15 year moving average					
2007	100	100			100	100				
2008	106,2	106,8	0,31%	21,0%	110,0	110,6	0,91%	87,1%	-0,60%	-66,1%
2009	95,9	106,3	0,05%	21,0%	119,4	87,8	2,48%	93,2%	-2,43%	-72,2%
2010	93,0	102,2	-0,18%	16,9%	127,6	48,5	-4,23%	73,0%	4,05%	-56,2%
2011	97,3	100,2	-0,05%	15,0%	136,2	33,1	-1,06%	43,8%	1,01%	-28,8%
2012	104,0	95,7	0,07%	14,8%	145,6	36,9	-0,02%	32,9%	0,09%	-18,1%
2013	110,0	92,4	0,00%	14,5%	155,7	42,1	0,68%	36,5%	-0,68%	-22,0%
2014	119,3	91,8	0,09%	14,3%	166,5	41,9	0,38%	41,8%	-0,29%	-27,5%
2015	129,1	91,8	0,07%	15,1%	177,8	39,1	0,13%	43,7%	-0,06%	-28,6%
2016	141,7	91,6	0,11%	16,1%	190,0	43,2	0,50%	43,4%	-0,39%	-27,3%
2017	169,4	91,6	0,20%	17,4%	204,8	38,1	0,03%	49,4%	0,17%	-32,1%
2018	183,3	91,1	0,23%	20,4%	222,1	35,8	-0,18%	47,2%	0,41%	-26,8%

The property price index changed by 83.5 per cent 2007-2018. The estimated capital stock index increases 122.1 per cent for the same period. The increase in the capital stock index is 21.1 per cent higher in the period than is the case for the property price index.

The average real interest rate is 3.6 per cent in 2007 and in 2018 it is down to 3.5 per cent. The change from 2007-2018 is 8.9 per cent.

The average nominal interest rate is 16 per cent in 2007 and in 2018 it is down to 5.7 per cent. The rates are 64.2 per cent lower at the end of the period.

The expenditure weight is somewhat lower with the annuity method, highest 21 per cent of the expenditures and lowest 14.3 per cent.

The highest nominal expenditure weight is 93.2 per cent and the lowest 32.9 per cent. This reflects the fact that nominal rates are calculated as a share of the real estate value and that figures is calculated as a percentage share of expenditures. The expenditures used are the same in both the annuity method and the capital stock method.

The results are more volatile for the capital stock method reflecting both higher capital stock index and lower nominal rate. The nominal rates results are much higher or lower than the results based on real interest rates. The difference in the nominal rates compared to the real rate is mostly due to inflation and thus inflation is a decisive factor in the results making them more volatile. The weights are much higher for the Swedish method because of the inflated interest rate. Higher weight leads to more influence of the price changes each year.

In Sweden the capital stock index (25-30 year moving average) for small houses shows very similar results as 25-30 years moving average of the property price index for small houses. The moving average change for the property index for smaller houses is also the same even for 20, 15 of 10 years moving averages for that index. This means that the volatility of the index is low and the price change is similar over the years as is the trend of prices that are reflected in the capital stock index.

The results for Iceland using the Swedish method are much more volatile leading to very different moving averages in different time intervals. It can be seen as the simulated capital stock index shows 21 per cent higher results than the property price index. The same is the case for the nominal interest rates that are much higher because of high inflation in Iceland.

The conclusion is therefore that the Swedish user cost method is more volatile applied in Iceland, mostly because of the volatility in the economic situation in Iceland.

Appendix 1	Main indexes 1994-2018, March 1997=100			
Year	**CPI**	**CPI less housing**	**Wage index**	**Building cost index**
1994	95,5	95,4	88,9	90,1
1995	97,1	96,8	92,9	93,0
1996	99,3	99,3	98,9	97,5
1997	101,1	101,0	104,2	101,8
1998	102,7	102,1	114,0	105,4
1999	106,3	104,6	121,7	107,8
2000	111,6	108,4	129,8	111,1
2001	119,1	115,7	141,3	118,0
2002	124,8	121,1	151,4	126,6
2003	127,4	121,9	159,9	130,7
2004	131,5	124,5	167,4	136,4
2005	136,8	125,7	178,7	143,6
2006	146,1	131,7	195,8	155,9
2007	153,4	135,0	213,4	170,1
2008	172,5	151,5	230,8	197,9
2009	193,2	175,9	239,9	223,5
2010	203,6	189,1	251,4	232,3
2011	211,7	196,4	268,4	247,4
2012	222,7	206,8	289,3	262,0
2013	231,3	214,7	305,7	271,2
2014	236,0	216,4	323,4	275,2
2015	239,9	216,7	346,6	287,5
2016	244,0	216,4	386,0	298,3
2017	248,3	211,6	412,4	303,7
2018	254,9	213,4	439,1	318,7
		Price changes per cent		
1994	1,5%	1,7%	1,2%	2,5%
1995	1,7%	1,4%	4,5%	3,2%
1996	2,3%	2,7%	6,4%	4,8%
1997	1,8%	1,7%	5,4%	4,5%
1998	1,7%	1,1%	9,4%	3,5%
1999	3,4%	2,4%	6,8%	2,3%
2000	5,0%	3,6%	6,6%	3,1%
2001	6,7%	6,8%	8,9%	6,2%
2002	4,8%	4,6%	7,1%	7,3%
2003	2,1%	0,7%	5,6%	3,3%
2004	3,2%	2,1%	4,7%	4,3%
2005	4,0%	0,9%	6,8%	5,3%
2006	6,8%	4,8%	9,5%	8,6%
2007	5,0%	2,5%	9,0%	9,1%
2008	12,4%	12,2%	8,1%	16,4%
2009	12,0%	16,1%	3,9%	12,9%
2010	5,4%	7,5%	4,8%	3,9%
2011	4,0%	3,8%	6,8%	6,5%
2012	5,2%	5,3%	7,8%	5,9%
2013	3,9%	3,8%	5,7%	3,5%
2014	2,0%	0,8%	5,8%	1,5%
2015	1,6%	0,1%	7,2%	4,5%
2016	1,7%	-0,1%	11,4%	3,8%
2017	1,8%	-2,2%	6,8%	1,8%
2018	2,7%	0,9%	6,5%	4,9%

Appendix 2 **Real property prices, deflated by**

March 1997=100

	CPI	Wage index	Building cost index
2001	122,3	103,0	123,4
2002	122,3	100,7	120,5
2003	133,7	106,5	130,3
2004	143,2	112,5	138,1
2005	176,8	135,4	168,5
2006	193,5	144,4	181,3
2007	201,5	144,9	181,8
2008	190,4	142,3	165,9
2009	153,5	123,6	132,7
2010	141,2	114,4	123,8
2011	142,1	112,1	121,6
2012	144,4	111,2	122,7
2013	147,0	111,3	125,4
2014	156,2	114,0	134,0
2015	166,4	115,2	138,9
2016	179,6	113,5	146,9
2017	210,9	127,0	172,4
2018	222,4	129,1	177,9
		Per cent change	
2001	0,2%	-1,8%	0,7%
2002	0,0%	-2,2%	-2,3%
2003	9,4%	5,7%	8,1%
2004	7,1%	5,6%	6,0%
2005	23,5%	20,4%	22,1%
2006	9,4%	6,6%	7,6%
2007	4,2%	0,3%	0,2%
2008	-5,5%	-1,8%	-8,7%
2009	-19,4%	-13,1%	-20,0%
2010	-8,0%	-7,5%	-6,7%
2011	0,6%	-2,0%	-1,8%
2012	1,6%	-0,8%	0,9%
2013	1,8%	0,1%	2,2%
2014	6,3%	2,5%	6,8%
2015	6,5%	1,0%	3,6%
2016	7,9%	-1,4%	5,8%
2017	17,4%	11,9%	17,4%
2018	5,4%	1,7%	3,2%

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