

## Appendix 1 Housing price indices – measurement methodologies

In recent months the housing component of the CPI has risen by far more than most other components of the index. Over the twelve months to May 2004, the “housing, heating and electricity” component increased by 7.8%. Excluding housing, the CPI rose by 2.2% over the same period, and the entire index by 3.2%. The items that explain the lion’s share of this surge in housing costs are “paid rent”, which rose by 7.2%, and “owner-equivalent rent”, which went up by 9.6%. What makes the latter item important is its weight in the CPI – more than 10%.

Changes in the price of “paid rent” are based on direct checks of changes in the rents that tenants pay for the use of housing. “Owner-equivalent rent” is an imputed measure of the housing costs incurred by the more than 80% of Icelanders who live in owner-occupied dwellings. It therefore needs to incorporate not only changes in market prices of housing, but also other factors affecting the cost of owner-occupancy, e.g. financing costs and depreciation. This appendix attempts to explain how owner-equivalent rent is calculated.<sup>1</sup>

### *Purchase price of housing*

Copies of all sales deeds for residential housing are submitted to the Land Registry. Deeds state the purchase price of the housing together with provisions on the liabilities undertaken by the buyer. These liabilities take four forms:

1. The buyer makes a cash payment on signing the deed of sale. If the buyer has taken a loan from a pension fund or a bank for the cash down-payment, it is classified here. So are supplementary loans from the Housing Financing Fund, which are not disbursed with a swappable mortgage bond but paid out in cash.<sup>2</sup>
2. The buyer commits to make payments at one or more dates in the near future, rarely more than one year ahead.
3. The buyer transfers bonds to the seller. These are generally housing bonds. When the buyer takes a loan from the Housing Financing Fund, the Fund issues the seller with housing bonds in return.
4. The buyer assumes the seller’s financial obligations in connection with the property.

According to the deed of sale, the purchase price is equivalent to the total nominal value of payments according to items 1 and 2 above, the nominal value of the housing bonds received by the seller under item 3 and the total current value of the principal of the financial obligations taken over by the buyer according to item 4.

For a realistic picture of the cost of owner-occupied housing, it is not enough to consider merely the buying price. The cost also depends on the scheduling of payments under item 2, the discount on housing bonds paid according to item 3 and the interest terms of the obligations taken over by the buyer under item 4. To produce a realistic evaluation of the cost of owner-occupied housing, the Land Registry revalues all payments according to the deed of sale at present discounted value.

### *Cash price of housing*

Since payments under item 1 are made in cash, they do not need to be revalued at present discounted value. The Land Registry uses overdraft interest rates to calculate the present discounted value of payments according to item 2. Currently, the first two items account for an average of 40% of the total value of a property.

The Land Registry uses the market yield on housing bonds plus a premium of 0.35% when it calculates the present discounted value of payments according to items 3 and 4. Its calculations are based

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1. Calculation of the housing component of the CPI was discussed in *Monetary Bulletin* 2003/4, in Box 1 on pp. 6-7 and Box 5, pp. 39-40.

2. The same will apply to all other Housing Financing Fund loans after July 1 this year, when the Fund’s new financing arrangements take effect. New loans will then be treated as down-payments to seal sales contracts, since after that date the Fund will pay for mortgage bonds with cash, rather than swapping them for housing bonds. Hence, after

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July 1 only liabilities that are taken over will be valued at present discounted value.

on the inflation-adjusted value of payments in connection with these obligations and the real yield on housing bonds. An effort is made to prevent calculations from being distorted by short-term fluctuations in yields. The premium of 0.35% is the same as the spread between real interest rates on Housing Financing Fund mortgage bonds (5.1%) and on housing bonds (4.75%). The yield as per items 3 and 4 is reviewed monthly.

One exception is made to this principle. When loans that are taken over have a low priority of lien and the loan-to-value ratio exceeds the level that the Housing Financing Fund allows in its lending to ordinary homebuyers, the interest charged by banks for such loans at the time the transaction takes place is used for discounting.

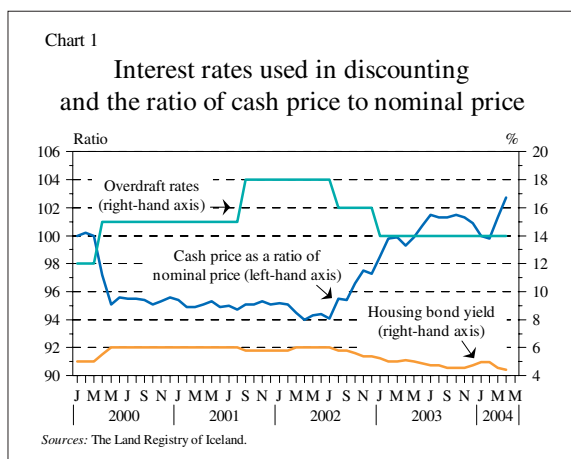


Chart 1 shows how the ratio of cash price and purchase price of housing were affected by changes in the interest rates that the Land Registry uses to discount payments.<sup>3</sup>

From January 2000 to January 2001, contractual purchase prices rose by 16.7%. At the same time, overdraft interest rates increased from 12% to 15% and housing bond yields from 5% to 6%. These increases raised cash prices by 11.4% over the period, which is significantly less than the rise in purchase prices. From the peak in interest rates in March

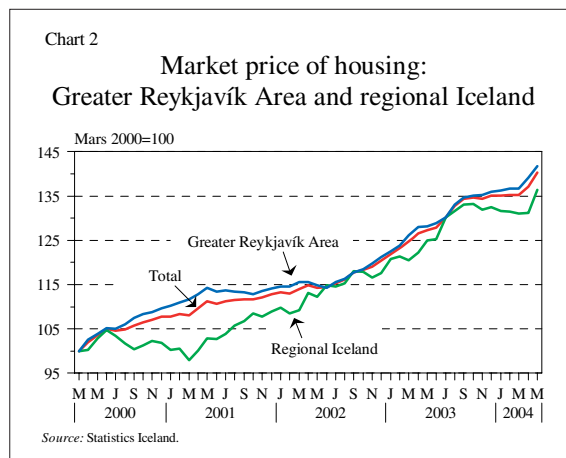
3. The chart uses data from the Land Registry. There may be a difference in the relative weights of the various housing categories compared with Statistics Iceland's methodology, but presumably only a slight one.

2002, purchase prices increased by 14.6% until April 2004 but the cash price by 24.6%. Statistics Iceland bases its calculations of "owner-equivalent rent" on the cash price of housing. This difference of 10 percentage points between the increases in the cash price of housing and in purchase price corresponds to a 1 percentage-point rise in the CPI over the period. When housing bond yields went down from 4.95% in January 2004 to 4.40% in April, this caused cash prices to rise by 6.6% but contractual purchase prices by 3.8%.

### Relative weights and other factors

The Land Registry calculates the cash price per square metre for several categories of residential housing. Deeds of sale are classified according to whether the housing is in the Greater Reykjavik Area or in the regions, and whether it is detached or multi-residential (i.e. an apartment). Each category is divided into four subcategories by size. The average price per square metre is then calculated for each subcategory.

Statistics Iceland uses the Land Registry's data for average price per square metre in its calculations of owner-equivalent rent. Some lag is inevitable in processing of data from deeds of sale: one month for prices in the Greater Reykjavik Area and two months for regional prices. To reduce the probability that differences in the characteristics of the housing sold will influence the estimate of the price, three-month averages are used. Thus the housing price in the Greater Reykjavik Area used for calculating the May CPI was the average price of housing sold in the period January to March.



Statistics Iceland weights the average price in each category by the number of transactions in the respective category over a three-year period. Recently the following weights were used: Detached housing in the Greater Reykjavík Area 13%, apartments in the Greater Reykjavík Area 59%, detached housing in regional Iceland 15% and apartments in regional Iceland 13%.

Chart 2 shows the development of cash prices for housing by location, from March 2000 to May 2004.

Housing price developments diverge sharply depending upon location. Over the four-year period examined here, however, the difference seems more pronounced in the short term than the long run.

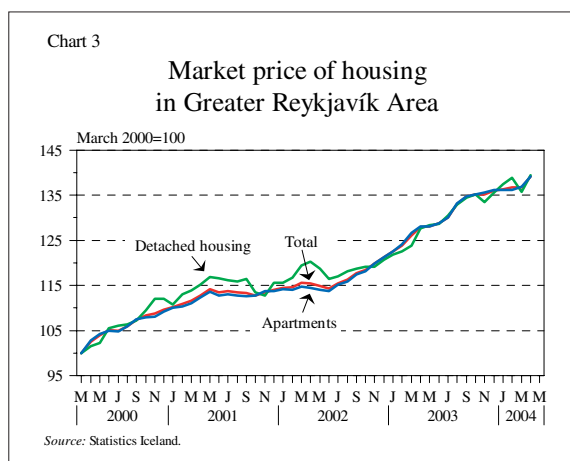


Chart 3 shows the development of cash prices for housing in the Greater Reykjavík Area, broken down into detached housing and apartments, also over the period March 2000 to May 2004.

Chart 3 does not reveal any significant divergence between price developments for detached housing and apartments, except in the very short run. The main difference seems to be that detached housing prices develop more unevenly. To some extent this probably reflects the diversity of detached housing, which poses a risk that changes in the composition of properties sold in any given period will influence the average price per square metre. This is especially likely when calculations are based on relatively few properties.

### Calculation of owner-equivalent rent

Estimations of the annual user cost of housing require assumptions to be made about the lifetime of the asset (and thereby annual depreciation) and interest expenses on account of capital deployed in it. Statistics Iceland assumes that housing has a lifetime of 67 years (with depreciation of 1.5% per year) and the value of the plot of land remains unchanged. For the sake of simplification, the combined value of the housing and plot of land are treated like an asset with a lifetime of 80 years (depreciated by 1.25% per year). Interest cost on owner-occupied housing is calculated in two ways: using real rates of interest on collateral loans, and 3% real interest on the part of the value of the housing which is classified as owner's equity.<sup>4</sup> The former alter in line with the terms of the loans specified in the housing sale agreement. Real interest on owner's equity is based on the long-term yield used in calculations of the pension funds' solvency. This yield changes very seldom. Recently, owners' equity has accounted for just over half the value of housing, and average real interest rates have been just over 5%.

Assuming a cash price of owner-occupied housing ( $S$ ), its lifetime ( $n = 80$ ) and real interest ( $r$ ), owner-equivalent rent is equal to the payment needed to pay off an annuity loan in the amount  $S$ , bearing  $r$  real interest, over  $n$  years. The following equation produces the annual payment ( $L$ ) of such a loan:  $L = r \cdot S [1 - (1 + r)^{-n}]^{-1}$ . This formula can be approximated by  $L = r \cdot S$  when  $n=80$  and  $r$  is not a very low figure, e.g.  $r > 2.5\%$ .

### The impact of interest rate changes

The above discussion shows that interest rates have a range of effects on owner-equivalent rent. They influence both the cash price ( $S$ ) and real interest rates on collateral loans ( $r$ ). However, there are instances where interest rates formally impact only one of the two aggregates. A reduction in overdraft rates, for example, causes  $S$  to rise but leaves  $r$  unchanged, thereby increasing the value of owner-equivalent

4. Other countries which follow this method for estimating owner-occupancy cost use nominal interest rates instead of the real rates used by Statistics Iceland. These countries are Finland, Sweden, Ireland, the UK and Canada. Long-term lending is generally at nominal rates in these countries, but is indexed on loans in virtually all cases in Iceland.

rent. A change in the market yield on housing bonds also affects  $S$  without directly altering  $r$ , raising owner-equivalent rent as well. On the other hand, if real interest rates on Housing Financing Fund mortgage bonds decrease without driving down housing bond yields or other market rates,  $r$  would decrease too.  $S$  would also go down by the equivalent of the payments on these loans. Such a reduction in interest rates would therefore produce a lower value for owner-equivalent rent.

Although movements in interest rates and yields in the market are independent of each other in the short run, in an active financial market they can be expected to have a close long-term correlation. A long-term correlation presumably exists between bond yields, pension fund loans, mortgage rates charged by banks and other credit undertakings, and short-term interest such as overdraft rates. A broad change in interest rates is therefore conceivable without causing any shift in the relative values of individual investment options. Such a change in the interest rate of all loans leaves  $S$  unaffected because the interest rates that the borrower has to pay change in tandem with those used in discounting. The part of  $r$  that is determined by housing loan rates will change, while the interest on homeowners' equity will not. A rise in real interest ( $r$ ) from 4% to 4.5% (i.e. a rise in real interest on housing loans from 5% to 6% while interest on the owner's equity is fixed at 3%) will lead to a 14% rise in owner-equivalent rent.

This example assumes that all interest rates would change consistently apart from owner's equity, i.e. all rates on all lending for housing purchases (both new and in the secondary market) would change in the same way as yields in the bond market. Of course such an assumption is unrealistic except in the very long term. Although pension fund loans and bank

loans carry variable interest rates, these generally do not alter as quickly as bond market yields. Furthermore, a large proportion of loans carry fixed rates, such as those from the Housing Financing Fund. This leaves the interest rates that determine  $r$ , and also  $S$  to some extent, much stickier than those used to discount the value of housing sales agreements. Presumably this difference is the main driver of the impact that interest rates have on owner-equivalent rent in the CPI.

It should be pointed out that under the planned change in Housing Financing Fund lending arrangements, scheduled to take effect on July 1 this year, interest rates on new housing loans will reflect yields on the bonds that the Fund issues to finance them, plus a fixed premium, but will remain fixed for the maturity of the loans. Thus interest rates on new housing loans will change in pace with market yields on these bonds, which will presumably continue to be used to discount the value of deeds of sale. Older Housing Financing Fund loans, on the other hand, will remain fixed as before, with the result that the part of  $r$  that is determined by real interest rates on housing loans will continue to be much stickier than bond market yields, although to a slightly less extent.

In conclusion, it should be underlined that the above discussion of the impact of interest rates assumes that housing purchase prices are independent of yields on housing bonds and other market interest rates. This assumption is supported by the empirical observation that nominal prices are sticky in many cases. However, there are also grounds for assuming that domestic interest rate levels affect housing prices. All things being equal, high interest rates should dampen demand for housing and bring down the purchase price.