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by

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Accuracy in forecasting macroeconomic variables in Iceland

Ásgeir Daníelsson[*]

Abstract

This paper discusses accuracy in forecasting of macroeconomic time series in Iceland. Until recently only the National Economic Institute (NEI) did macroeconomic forecasting in Iceland. Extensive analysis of forecasting can therefore only be done for the forecasts made by this institution during 1974-2002.

The paper analysis macroeconomic forecasts published by the Central Bank of Iceland (CBI). It also analysis the accuracy of the first realeases of data from Statistics Iceland as “forecasts” of final (or the most recent) data during recent years. Forecasts made by international institutions like OECD and IMF are not included.

The paper finds that errors in forecasting of GDP and private consumption have declined and that the performance of the forecasting for these variables has improved on some measures. But the volatility in the series has also decreased so when the forecast errors are compared to measures of the shocks that hit the economy the forecasting of changes in GDP do not seem to have improved. For some of the main components of GDP like export, imports and investments, the forecast errors have not decreased.

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1. Introduction

In this paper we will study forecast errors and try to assess the quality of macroeconomic forecasting for annual changes in macroeconomic time series for the Icelandic economy during the last 30 years.[1] Different methods have been suggested to assess the quality of forecasts. One method is simply to look at some measure of the forecast errors themselves, e.g. the mean absolute forecast errors (MAFE), mean square forecast errors (MSFE) or the root mean square forecast errors (RMSFE). If these measures are declining then that means that forecasting is improving. Another method compares some measure of forecast errors to the same measure of errors from some naive forecasting method (zero change forecast as proposed by H. Theil[2] or last observed change, which is the optimal forecast if the changes follow random walk, or some other simple or naive forcasting method using the infromation available at the time of forcasting).

In recent years researchers studying forecasts for the US economy have observed that errors in macroeconomic forecasts have been declining but errors in forecasts using simple or naive methods have also been declining. In some cases the latter have declined faster than the errors in serious macroeconomic forcasts done by private and public institutions causing a decline in the quality of these forecasts when compared to the forecasts using the naive methods.[3]

A third method compares some measure of the forecast errors to some measure of the shocks that the economy was subjected to during the forecast period, e.g. the standard deviation of the actual values of the variable that was forecasted or some other measure of such shocks. When assessing forecast errors in recent times this measure takes into account that for many developed economies there is evidence of a

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[1] Comparable studies for other economies usually study quarterly time series and forecasting of quarterly changes in these series. This is unfortunately not yet possible for Iceland as time series for quarterly national account data are only available from the first quarter of 1997. Time series for quarterly forecasts are much shorter as quarterly forecasts have only been made since the first quarter of 2006 when the Central Bank of Iceland (CBI) started to use its quarterly model (QMM) in forecasting (See Daníelsson et al. 2006). In this paper we will therefore only study time series of changes in annual data and forecasts for such changes.

[2] For discussion of Theil's proposals see Clements and Hendry (1998), pp. 63-65.

[3] See e.g. D'Agostino and Whelan (2007) and D'Agostino et al. (2007) and the references therein. D'Agostino and Whelan (2007) find that the advantage in forecasting by the US FED that Romer and Romer (2000) found has disappeared, except in forecasting of inflation in the very near term, especially the current quarter.

significant reduction in the volatility of the shocks in the macroeconomic time series, the so-called great moderation.[4]

Theoretically one should compare the forecast errors to the shocks that are unforeseeable at the time of forecasting. An efficient (optimal) forecast is one where the forecast errors are orthogonal (i.e. uncorrelated) to the information available at the time of forecasting. Estimations of this kind of efficiency of actual forecasts is quite difficult. We will therefore simply assume that some measure of the volatitlity in the series that is to be forecasted, e.g. the standard deviation of the relative changes in the series, or some measure of the aggregate volatility of the shocks that hit the economy, e.g. the standard deviation of the changes in the Gross National Income (GNI), is proportional to the unforeseeable shocks that the Icelandic economy was subjected to during the relevant period of time. In this case it is reasonable to nomalise the RMSFE with the standard deviations of changes in GDP or in GNI in relevant periods to obtain measures that can be used to compare forecast performances over time.

Some economists (see e.g. D'Agostino and Whelan 2007) argue that the great moderation, i.e. the reduction in the volatility in macroeconomic variables (and inflation), was caused by better economic policies. If these improved economic policies react to predictable shocks to macroeconomic variables they reduced the overall volatility by reducing predictable shocks. In this case the improved economic policies create a situation where a larger share of the smaller overall variability is unpredictable. In this case normalising RMSFE with the standard deviations of changes in the GDP or in the GNI will not produce a reasonable measures for comparing forecast performances over time.

Forecasting performance of NEI has been studied previously in three papers: Felixson and Gudmundsson (1988), Sighvatsson (1996) and Ólafsdóttir (2006). The last study covers the period from 1980 to 2002 when NEI was abolished. The differences between this study and the above mentioned studies are that we make formal tests of the bias in the forecasts and find that it is often significant. This means that the forecasts do not meet the first requirement of what has been called the weak form of informational efficiency.[5] We find that the forecasts meet the second

[4] See e.g. McConnell and Perez-Quiros (2000), Blanchard and Simon (2001) and Stock and Watson (2002) on the great moderation in the US and Stock and Watson (2003) and Summers (2005) on the great moderation in other countries. See Giannone et al. (2007) for the view that the shocks have not become smaller. See Daníelsson (2008) on the great moderation in Iceland.

[5] See e.g. Öller and Barot (1999) and the references therein.

requirement of no autocorrelations in the forecast errors. Details of the testing for autocorrelations are not reported in this paper.

We also study correlations between forecast errors for the different components of GDP and relate the forecasting performances to the volatility in the Icelandic macroeconomic data which has been studied recently in Daníelsson (2008). Finally, we have included analysis of forecasting performances of the CBI and of the first releases of national account data from Statistics Iceland.

This paper is organized so that Section 2 discusses the methodology in assessing accuracy of forecasts. Section 3 discusses errors in macroeconomic forecasts made by the National Economic Institute (NEI) during 1974-2002. Section 4 discusses errors in macroeconomic forecasts published in CBI's Monetary Bulletin during 1999-2007. Section 5 discusses errors in the first releases of national account data from Statistics Iceland and Section 6 concludes.

2. Methodology

If F_t is the value of some variable in time t forecasted at some earlier date and A_t is the measured value of the variable in time t then the forecast error is $e_t = F_t - A_t$. For assessing the overall performance of forecasting we need some function that aggregates these forecast errors. Ideally the weights of the different forecast errors should reflect the costs of making the mistakes. Unfortunately, it is only rarely that such costs are available. In this situation it is reasonable[6] to use simple aggregating functions that have convenient mathematical properties like Mean Square Forecasting Error (MSFE = $\frac{1}{H}\sum(F_t - A_t)^2$ where H is the number of observations on the forecast errors) or Root Mean Square Error (RMSFE = $\sqrt{\frac{1}{H}\sum(F_t - A_t)^2}$) to assess forecasting accuracy. Some researchers use the Mean Absolute Forecast Error (MAFE = $\frac{1}{H}\sum|F_t - A_t|$) to avoid giving too much wheight to few very large forecast errors.

[6] See Clements and Hendry (1998) p. 67.

Clements and Hendry (1998), chapter 3, explains some difficulties in using these measures to assess forecasting accuracy in some circumstances.[7] We will ignore these difficulties and use RMSFE below to assess forecast accuracy.

One method to assess the quality of a forecast is to compare the RMSFE of the forecasts to the RMSFE from some naive forecasting method. If the naive methods gives the forecasts F_t^n then $\sqrt{\frac{1}{H}\sum\left(F_t^n - A_t\right)^2}$ is the RMSFE for these forecasts and the ratio

$$U_n = \sqrt{\frac{\sum\left(F_t - A_t\right)^2}{\sum\left(F_t^n - A_t\right)^2}} \qquad (2.1)$$

is a measure of the relative efficiency of the forecasting method producing F_t relative to the naive forecasting method. Lower U_n means that the forecasting is relatively better and a forecast where $U_n = 0$ is a forecast where all forecast errors are zero, i.e. where $F_t = A_t, \forall t$. If the RMSFE of the forecasts is larger than the RMSFE of the simple forecast then $U_n > 1$. Good forecasts should therefore have a value of relative efficiency, U_n, well below 1.

H. Theil proposed Theil's U (or U_2 as he called it to distinguish it from the first U measure he proposed) for measuring forecast accuracy:

$$U_2 = \sqrt{\frac{\sum\left(F_t - A_t\right)^2}{\sum A_t^2}} \qquad (2.2)$$

The term in the denominator can be considered as a way to normalize the root square forecast error (RSFE) in the nominator to make these measures comparable. But if the intention is to compare different forecasting methods by measuring the forecast errors for the same variable over the same period of time then this

[7] In Section 3.4.2 they point out that choosing the model with smallest MSFE is neither necessary nor sufficient for a model to have constant parameters nor provide accurate forecasts and that in scalar processes, choosing the model with smallest MSFE will not ensure forecast encompassing. In Section 3.5 they explain that the MSFE-based measures of forecast accuracy are not invariant to different but isomorphic representations of the same system.

normalisation is not necessary because it involves division with the same denominator, $\sum A_t^2$.

When data do not have a specific unit, as is the case with data on relative changes or log differences which we are concerned with in this paper, RMSFE is also unit-free. Different units are therefore not an obstacle for comparing RMSFEs. In this situation the only purpose of normalising RMSFEs for different variables is to obtain a measure of forecasting accuracy that takes into account that for some reasons it is not equally difficult to forecast the variables during different periods of time. The aim of the normalisation should then be to compensate for these differences.

It is easy to see that Theil's U_2 can be derived from equation (2.1) by using the naive forecast $F_t^n = 0, \forall t$.

Theil proposed the following docomposition of the MSFE:

$$MSFE = H^{-1}\sum_{h=1}^{H} e_{T+h}^2 = \left(\overline{F} - \overline{A}\right)^2 + \left(S_F - S_A\right)^2 + 2\cdot(1-r)S_F S_A \qquad (2.3)$$

where $e_{T+h} = F_{t+h} - A_{t+h}$, $\overline{X}$ is the average value and S_X is the standard deviation of some variable X and r is the sample correlation coefficient for F and A. Theil interpreted the first term as indicating the bias in the forecasts, the second term as indicating the bias in the forecasting of the standard deviation of the series and the third term as the random part or the covariance proportion. Standardizing the sum above by dividing through (2.3) with MSFE gives:

$$\frac{\left(\overline{F} - \overline{A}\right)^2}{MSFE} + \frac{\left(S_F - S_A\right)^2}{MSFE} + \frac{2\cdot(1-r)S_F S_A}{MSFE} = 1 \qquad (2.4)$$

Granger and Newbold (1973) show that this decomposition can be misleading for the optimal predictor in simple time series models. They prefer a second decomposition that Theil proposed, namely:

$$MSFE = H^{-1}\sum e_{T+h}^2 = \left(\overline{F} - \overline{A}\right)^2 + \left(S_F - rS_A\right)^2 + \left(1 - r^2\right)S_A^2 \qquad (2.5)$$

as “the formulation of the last two terms implies that the second should now tend to zero (along with the first) for a good forecast, leaving the third term to approach unity after scaling.” (Clements and Hendry, 1998, p. 65).

If the forecasting errors are independent and nomally distributed then it is possible to test if the bias is significant by using that in this case $\frac{\sqrt{H}\left(\overline{F}-\overline{A}\right)}{\sqrt{\frac{1}{H-1}\sum\left(F_t-A_t-\overline{F}+\overline{A}\right)^2}}$ has a t-distribution with $H-1$ degrees of freedom.

If the forecasting errors are not independent or identically normally distributed then this test will be biased. Various alternatives have been proposed. Öller and Barrot (1999, p. 112) propose to estimate the univariate process of the forecasting errors and test if the constant is significant. Another way to solve the problem of autocorrelation which solves the problem of heterocedasticity as well is to use Newey-West standard deviations that are robust to both autocorrelation and heterocedasticity. We will use this latter method below.

All these methods depend on the assumption that the errors are normally distributed. In most cases discussed below this assumption is not rejected. In spite of this we will also use the Wilcoxon signed rank sum test to test for biases. This test demands that the errors are independent draws from a continuous and symmetric population but not that they are normally distributed.

It is obviously interesting to see if the forecasting errors are increasing, decreasing or constant over time. This can be done by regressing some measure of forecasting accuracy on a time trend. It is also interesting to see how forecasters are performing in relation to the variability of the variable that is to be forecasted. If the variability is large then one would expect RMSFE to be high because it is easier to forecast variables which are less volatile. This leads to estimates of forecasting accuracy like

$$\frac{RMSE}{SD}=\frac{\left[\frac{1}{H}\sum_{t=h}^{H}(A_{T+h}-F_{T+h})^2\right]^{1/2}}{\left[\frac{1}{H}\sum_{h=1}^{H}\left(A_{T+h}-\overline{A}\right)^2\right]^{1/2}}=\frac{\left[\sum_{t=1}^{H}(A_{T+h}-F_{T+h})^2\right]^{1/2}}{\left[\sum_{h=1}^{H}A_{T+h}^2-H\cdot\overline{A}^2\right]^{1/2}} \qquad (2.6)$$

where SD is the standard deviation of the variable that is forecasted. It follows directly from (2.6) that $RMSE/SD \geq U_2$.

$RMSE/SD$ is also the relative forecasting efficiency of the forecast against the naive forecast of $F_t^n = \overline{A}$. This forecast is optimal (in the sense of minimising RMSFE) in the class of forecasts $F_t^n =$ constant, $\forall t$, which includes Theil's naive forecast of $F_t^n = 0$. But as the average value of the variable, $\overline{A}$, is not known at the time of the forecasting it gives a bias against some actual forecasts that uses only the information available at the time of forecasting to compare them with the forecast $F_t^n = \overline{A}$. On the other hand, it may seem to give actual forecasts done at the time an unjust advantage when they are compared to the naive alternative $F_t^n = 0$. Usually it is known when changes in macroeconomic variables are forecasted that the average changes will be above zero, which means that Theil's naive forecasts are biased.

One naive forecast method that would do better than Theil's method of $F_t^n = 0$ in many cases is to use the latest known (at the time of the forecasting) estimate of the variable. This forecasting method is optimal if the time series follows random walk. Using the average value of the variable for some recent period known at the time of the forecasting gives unbiased forecasts in the case where the parameters of the data generating process are stable.

Ólafsdóttir (2006) compares NEI's forecasts to forecasts from equations she obtains by estimating univariate AR(2) models for changes in GDP. For forecasting GDP in year $t+1$ she uses a model estimated from data for the period from 1945 to year t. Because of frequent and large data revisions one should only use data that were available at the time of forecasting in these estimations. Ólafsdóttir finds that for the periods 1981-2002 and 1992-2002 the forecasts from the AR(2) models are inferior to NEI's forecasts for year $t+1$ made in the autumn of year t.

Pétursson (2000) estimates AR(2) model and Markov-switching model where the trend component in the time series (or the constant in the autoregressive equation for the first difference of the series) follows a markovian two states process. When considering the period 1991-1998 Pétursson finds that in one-year ahead out-of-sample forecasts the Markov-switching model performs better than both the AR(2) model and NEI when the forecasts are compared in terms of mean absolute errors, while NEI's forecasts perform best if the Root Mean Square Error is used. Pétursson finds that for the period 1993-1998 NEI's forecasts perform much worse than the forecasts from the AR(2) model and the forecasts from the Markov-switching model independently of the measure chosen for comparing the forecasts, while the Markov-switching model performs best.

Ólafsdóttir (2006) and Pétursson (2000) discuss performances of the different forecasting methods in terms of forecasting turning points of the Icelandic business cycle and direction of changes in the variables. These aspects of the forecasts will not be discussed in this paper.

3. Errors in NEI's forecasts

Except for a few of the very last years of its existence from 1974 to 2002 NEI was the only institute in Iceland making macroeconomic forecasts. The institute was obliged by law to make forecasts that were used in the planning for state budget and published in the National Budget (*Þjóðhagsáætlun*) in the beginning of October each year. These forecasts were based on the information available in September in a given year. Most of the times NEI also published forecasts in the National Economy (*Þjóðarbúskapurinn*) or in On the National Economy (*Ágrip úr þjóðarbúskapnum*) that was published in March/April.

In the beginning NEI's macroeconomic forecasts were made with very simple models. The first rigorous model that NEI used in its forecasting was completed in 1989 and used to prepare the forecast published in the spring of that year.[8]

Table 3.1 below shows some statistics on errors in the forecasts for annual growth in GDP for the next year that were published in the National Budget.[9] The second column shows the average forecast error, $F_t - A_t$. The negative sign indicates that the actual growth in GDP (GNP) was on average larger than forecasted.

[8] In *Þjóðhagsstofnun* (1989) there is a brief description of this model. A more complete account can be found in Baldursson (1990).

[9] or GNP as NEI forecasted changes in GNP until 1983 (forecasting for 1984) when it started to forecast changes in GDP.

Table 3.1

Errors[1] in the National Budget (Þjóðhagsáætlun, September in year t-1) forecasts of changes in GDP (%)

	Av. error	RMSFE	St.dev. D(GDP)	St.dev. D(GNI)	RMSFE/ St.d.(GDP)	RMSFE/ St.d.(GNI)	Theil's U	P-value One tail	Wilc. test[2]
1974-1986	-2.95	3.75	3.13	4.83	1.20	0.78	0.76	0.032	**
1987-2002	-1.58	2.84	3.05	3.59	0.93	0.79	0.74	0.034	**
1977-1993	-2.42	3.59	3.63	4.53	0.99	0.79	0.79	0.026	**
1981-1993	-1.76	3.05	3.40	4.22	0.90	0.72	0.81	0.065	**
1994-2002	-1.87	2.79	2.11	2.14	1.33	1.30	0.68	0.068	*
1977-1994	-2.63	3.79	3.53	4.40	1.07	0.86	0.84	0.017	**
1981-1994	-2.08	3.38	3.30	4.07	1.02	0.83	0.90	0.041	*
1995-2002	-1.33	1.99	2.25	2.26	0.88	0.88	0.48	0.094	*
1977-2002	-2.23	3.34	3.16	3.87	1.06	0.86	0.76	0.007	**
1981-2002	-1.81	2.95	3.01	3.62	0.98	0.81	0.76	0.015	**
1974-1993	-2.34	3.48	3.52	4.76	0.99	0.73	0.77	0.020	**
1974-2002	-2.19	3.28	3.12	4.14	1.05	0.79	0.75	0.005	**

[1] Errors compared to the most recent (March 2008) national account estimates

[2] One sided test Wilcoxon's rank sum test; * = significant at 5%, ** = significant at 1% level.

The third column shows the RMSFE. For comparison the fourth column shows the standard deviation of changes in GDP (GNP until 1983) and the fifth column shows the standard deviation of changes in GNI. The sixth column shows the ratio of RMSFE and the standard deviation of changes in GDP which is used as a measure of the shocks that hit the Icelandic economy during the relevant time period and the seventh column shows the ratio of RMSFE and the standard deviation of changes in GNI as a measure of the shocks, including the terms of trade shocks. The eighth column shows the U_2 statistic that H. Theil proposed. The second last column shows p-values for one-tailed t-tests for the significance of the biases of the forecasts. Newey-West standard deviations are used so that the results are robust for autocorrelations and heteroscedasticity but depend on the assumption of normal distribution. An alternative test of the significance of the biases that does not rely on the assumption of normal distribution is the non-parametric Wilcoxon’s rank-sum test. The last column in shows significance of the bias in a one-tailed Wilcoxon’s test.

Table 3.1 shows the different values calculated for the whole sample 1974-2002 and for several subsamples. In the first two lines the sample is split into two samples of almost equal size. For the latter period, 1987-2002, the average error is much lower than in the former, and the RMSFE is also much lower but Theil’s U_2 statistic is almost equal. The reason for this is that the denominator in Theil’s U_2 statistic, the square root of the sum of squares of actual growth in GDP, is much larger in the earlier period.

The standard deviation of changes in GDP is almost the same for the two subsamples while the standard deviation of changes in GNI is much lower in the latter subsample. If the RMSFEs are normalised with the standard deviations of changes in GDP the normalised measure of forecast quality indicates improvement in the latter period, while if the RMSFEs are normalised with the standard deviations of changes in GNI the normalised measure of forecast quality indicates no improvement in line with the U_2 statistic.

Daníelsson (2008) estimates a breakpoint in the volatility of GNI in 1977. For that reason Table 3.1 contains analysis of subsamples starting in 1977. The sample period 1977-2002 is divided into subsamples before and after 1994 to see if forecasting improved after the inflation had been contained in the early 1990s. Besides showing the various statistics for the periods 1977-1993, 1994-2002 and 1977-2002 Table 3.1 also shows statistics for 1977-1994 and 1995-2002. The reason for including results for the period 1995-2002 is that Daníelsson (2008) finds a breakpoint in the volatility in fishing and fish processing, the traditional source of business cycle fluctuations in Iceland, in 1995. Including results for both 1994-2002 and for 1995-2002 in Table 3.1 shows how sensitive the statistics on forecast errors are to individual observations. Because the samples are relatively small even one year with exceptionally large forecast error like 1994 causes large changes in the statistics in the table. If 1994 is in the later sample Theil's U_2 shows a small improvement in forecasting accuracy from 0.79 in 1977-1993 (or 0.81 in 1981-1993) to 0.68 in 1994-2002, but if 1994 is in the first sample Theil's U_2 shows a large improvement from 0.84 in 1977-1994 (or 0.90 in 1981-1994) to 0.48 in 1995-2002. RMSFEs normalised with the standard deviation in changes in GDP increases when 1994-2002 is compared to periods ending in 1993 while it decreases a bit when 1995-2002 is compared to periods ending in 1994. RMSFEs normalised with standard deviations of changes in GNI do not indicate any improvement in the forecasting over time.

Table 3.1 shows results for periods starting in 1981 rather than 1977. Ólafsdóttir (2006) uses this sample in her study of the forecasting performance of NEI during

1981-2002.[10] When studying the errors in the forecasting of the components of GDP below we will also use the sample starting in 1981.

Table 3.2 shows the same statistics as Table 3.1 for the forecasts of changes in GDP (GNP) in a given year that NEI published in the National Economy. These forecasts were prepared during March/April of the same year. It is therefore to be expected that these forecasts are better than the forecasts made roughly 6 months earlier and published in the National Budget. It is therefore a bit surprising that the forecasts in the National Economy are much worse than those in the National Budget for the period 1974-1986. The average forecast error and the RMSFE is larger. The errors in the forecasts in the National Economy are also larger for the period 1977-1993 but the difference is small. For the samples covering the most recent years the forecasts in the National Economy are much better than the forecasts in the National Budget as is to be expected.

[10] Ólafsóttir (2006) divides the sample into two subsamples of equal size 1981-1991 and 1992-2002. There is a slight difference between the results in Table 3.1 and the result in Ólafsdóttir (2006) because we use more recent estimates from Statistics Iceland of changes in GDP (GNP) than she did and because we have taken into account the slight differences caused by the fact that NEI forecasted annual changes in GNP rather than GDP until 1983 when it forecasted the change in GDP for the year 1984.

Table 3.2

Errors[1] in the National Economy, March/April in year t, forecasts of changes in GDP (%)							
	Av. error	RMSFE	RMSFE/ St.d.(GDP)	RMSFE/ St.d.(GNI)	Theil's U	P-value one tail	Wilc. test[2]
1974-1986	-3.05	4.40	1.40	0.91	0.90	0.064	**
1987-2002	-1.12	2.24	0.73	0.62	0.58	0.039	*
1977-1993	-2.27	3.35	0.92	0.74	0.75	0.036	**
1981-1993	-2.11	2.83	0.83	0.67	0.75	0.041	**
1994-2002	-1.00	2.19	1.04	1.02	0.54	0.102	
1977-1994	-2.40	3.45	0.98	0.78	0.78	0.026	**
1981-1994	-2.29	3.00	0.91	0.74	0.80	0.029	**
1995-2002	-0.53	1.63	0.72	0.72	0.39	0.197	
1977-2002	-1.83	2.97	0.94	0.77	0.69	0.014	**
1981-2002	-1.65	2.59	0.86	0.71	0.66	0.015	**
1974-1993	-2.43	3.68	1.05	0.77	0.84	0.031	**
1974-2002	-1.99	3.24	1.04	0.78	0.76	0.013	**

[1] Errors compared to the most recent (in March 2008) national account estimates

[2] One sided test Wilcoxon's rank sum test; * = significant at 5%, ** = significant at 1% level.

Theil’s U_2 statistic in Table 3.2 indicates that the quality of NEI’s forecasts has improved over time while the standardised RMSFEs’ indicate improvement if 1994 is in the first period but deterioration if it is in the latter period.

The second last column shows p-values for one-tailed t-tests for the bias in the forecasts using Newey-West standard deviations and the last column shows the significance of the bias in a one-tailed Wilcoxon’s test.

Table 3.3 shows some measures of the quality of NEI’s forecasts for the main macroeconomic variables for 1981-2002. The sample has been divided into two subsamples, 1981-1994 and 1995-2002. The table shows that the RMSFE of the forecasts was substantially lower in the latter period in the case of GDP and private consumption, but it was actually higher in the case of investments and imports. Theil’s U_2 is lower in the latter period than in the former period in all cases, indicating better forecasting, but the difference is very small in the case of export but fairly large in the case of private consumption and especially in the case of GDP.

Table 3.3

Statistics indicating forecast errors (%)					
Av. error	**GDP/GNP**	**C**	**I**	**X**	**M**
1981-1994	-2.08	-2.88	-2.08	-1.14	-2.26
1995-2002	-1.33	-1.12	-8.32	-1.87	-4.83
1981-2002	-1.81	-2.24	-4.35	-1.40	-3.19
RMSFE					
1981-1994	3.38	5.47	7.65	6.33	7.78
1995-2002	1.99	3.24	14.68	5.12	8.97
1981-2002	2.95	4.78	10.75	5.92	8.23
RMSFE/St.d.(relevant variable)					
1981-1994	1.02	0.92	0.93	1.04	0.85
1995-2002	0.88	0.72	0.90	1.43	0.88
1981-2002	0.98	0.87	0.89	1.11	0.85
RMSFE/St.d.(changes in GNI)					
1981-1994	0.83	1.34	1.88	1.55	1.91
1995-2002	0.88	1.43	6.51	2.27	3.98
1981-2002	0.81	1.32	2.97	1.63	2.27
Theil's U_2					
1981-1994	0.90	0.90	0.96	0.99	0.87
1995-2002	0.48	0.56	0.87	0.93	0.77
1981-2002	0.76	0.80	0.90	0.97	0.82
p-values of t-statistics					
1981-1994	0.041	0.060	0.174	0.255	0.142
1995-2002	0.102	0.250	0.147	0.177	0.153
1981-2002	0.015	0.038	0.060	0.138	0.054
Significance of bias. Wilcoxon's signed rank sum test					
1981-1994	*	*			
1995-2002	*		almost *		almost *
1981-2002	**	*	almost *		almost *

* = significance at 5% level, ** = signficance at 1% level.
One sided tests.

RMSFE normalised with the standard deviation of the variable that was forecasted shows some improvements in the forecasting of GDP and especially of private consumption even if the improvements are not as dramatic as when measured with Theil's U_2. This measure indicates that NEI's forecasts for investments and imports were roughly equally good in the two period while the forecasts of exports were much worse in the latter period than in the former one.

If terms of trade shocks are taken into account by normalising RMSFE with the standard deviation of changes in GNI, then there is deterioration in the forecasting performance in the latter period compared to the former one.

The last two sections in Table 3.3 shows signifcance of the biases in the forecasts. The p-values for the t-statistics (using Newey-West standard deviations) gives some indication of the biases. These tests give similar results as the Wilcoxon's rank sum tests. The results show that the biases in the forecasting of changes in GDP were significant in both subperiods and there are strong indications of negative biases in several other cases. In spite of the fact that the average errror in the forecasts for changes in investments in the period 1995-2002 is -8.3% it is not quite significant at the 5% level in a one-tailed test.

The large reduction in the errors in the forecasting of GDP is largely due to the reduction in the errors in the forecasting of private consumption. But at the same time as the forecasting of private consumption improves there is relatively small reduction in the errors of forcasting export (and a deterioration of the forecasting performance when the large reduction in the volatility in the series is taken into account) and increases in the forecasting errors of imports and investments. This indicates that some of the reason for the increased forecasting accuracy in the case of changes in GDP is that the correlations of the forecasting errors of the components of GDP have changed. Table 3.4 shows the correlations coefficients for the forecasting errors of GDP and its main components on the expenditure side, except government consumption.

The table shows very high correlations between the errors in the forecasts for changes in private consumption and in the forecasts for changes in investment on the one hand and in the forecasts for imports on the other. These high correlations help to lower the errors in the forecasting of changes in GDP.

Table 3.4 shows that the correlation between investment and imports is higher in the period 1995-2002 than in the period 1981-1994 while the correlation between export and consumption is lower (negative) during the latter periods. In other cases the correlations change so as to increase rather than decrease the errors in the forecasting of changes in GDP when it is forecasted by the formula $Y_t = C_t + G_t + I_t + X_t - M_t$.

Table 3.4

Correlations of forecast errors 1981-2002

	GDP/GNP	C	I	X	M
GDP/GNP	1.000	0.651	0.502	0.370	0.499
C	0.651	1.000	0.609	-0.124	0.815
I	0.502	0.609	1.000	-0.150	0.830
X	0.370	-0.124	-0.150	1.000	-0.002
M	0.499	0.815	0.830	-0.002	1.000

Correlations of forecast errors 1981-1994

	GDP/GNP	C	I	X	M
GDP/GNP	1.000	0.745	0.701	0.325	0.629
C	0.745	1.000	0.830	-0.013	0.903
I	0.701	0.830	1.000	-0.313	0.795
X	0.325	-0.013	-0.313	1.000	0.066
M	0.629	0.903	0.795	0.066	1.000

Correlations of forecast errors 1995-2002

	GDP/GNP	C	I	X	M
GDP/GNP	1.000	0.142	0.593	0.644	0.335
C	0.142	1.000	0.731	-0.467	0.873
I	0.593	0.731	1.000	-0.020	0.917
X	0.644	-0.467	-0.020	1.000	-0.190
M	0.335	0.873	0.917	-0.190	1.000

Correlations of forecasted and actual changes

	GDP/GNP	C	I	X	M
1981-1994	0.547	0.619	0.376	0.118	0.642
1995-2002	0.715	0.809	0.659	-0.212	0.715
1981-2002	0.611	0.617	0.578	0.070	0.699

The last section in Table 3.4 shows the correlations between the forecasted changes and the actual changes. The poor forecasting of export can be seen from the almost zero correlations between the forecasted changes in export and the actual changes. On this measure the forecasts in the period 1995-2002 were actually poorer than those in 1981-1994.

Some researcher studying the US economy (See e.g. D'Agostino and Whelan 2007 and D'Agostino et al. 2007) have documented that even if errors in serious economic forecasts have been declining in recent years, errors in naive forecasts have been declining faster so that the forcasting performances of the serious forecasts have been deteriorating when compared to the naive forecasts. This is true for forecasts prepared by both public institutions (the FED) and private forecasters. It is suggested that this phenomena is connected to the reduction in the volatility of macroeconomic variables, the great moderation.

Daníelsson (2008) documents the existence of a reduction in the volatility of some macroeconomic variables in Iceland. It is shown that there are significant breakpoints in GDP, GNI, terms of trade and exports in the 1970s. It also documents a breakpoint in the volatility in fishing and fish processing in 1995. Except for the last one these breakpoints are a bit too early to be relevant for this study of forecast errors in Iceland.

Table 3.5 shows standard deviations of changes in macroeconomic variables in the periods considered in Tables 3.1-3.4 above. The table shows that the volatility of GDP, private consumption, government consumption and exports is lower during 1995-2002 than during earlier periods included in the table.

Table 3.5

Standard deviations of changes (%)

	GDP	C	G	I	X	M
1981-1994	3.22	5.98	2.42	8.25	6.11	9.15
1995-2002	2.25	4.51	1.54	16.35	3.58	10.20
1981-2002	2.94	5.47	2.14	12.04	5.32	9.63
1974-1986	2.81	6.05	2.62	7.92	6.65	8.97
1987-2002	3.05	5.88	1.76	13.49	4.57	10.55
1977-1994	3.43	6.01	2.37	8.54	6.29	9.16

Some of these differences are close to being significant on an F-test for equal variances even if observations are very few (e.g. changes in export between 1981-1994 and 1995-2002 with a p-value of 0.081) but others are further away from being significant on the usual 5% level.

Table 3.5 shows also that the volatility in fixed investments and in imports was actually larger in 1995-2002 than during earlier periods.

The RMSFE of forecasting for GDP and private consumption is substantially lower for the period 1995-2002 than in earlier periods. These forecasts also score better on Theil's U_2 and marginally better on the RMSFE/St.dev. measure.[11] For export and import no improvement can be seen and the forecasting of investment had actually higher RMSFE in 1995-2002 than in earlier periods. As the volatility was also higher in 1995-2002 there are only small differences in RMSFE/St.dev.

4. Errors in Central Bank of Iceland's forecasts

The Central Bank has published macroeconomic forecasts in each issue of its Monetary Bulletine, the first one in November 1999 and then each quarter from 2000 to 2005. Since 2006 the Monetary Bulletin has been published three times a year. The

[11] As discussed above the picture changes somewhat if 1994-2002 is used as a reference.

first forecasts were prepared by NEI. The first forecast prepared by specialists at the bank was published in the 2002/4 issue of the Monetary Bulletine. Because so few observations are available on forecasts made by the CBI staff we will consider the forecasts published by the CBI independently of which institution actually prepared the forecast.

In terms of available information the forecasts for the coming year published in the third quarter are roughly equivalent to NEI's forecasts that were published in the National Budget and the forecasts for the current year published in the first quarter are roughly equivalent to NEI's forecasts that were published in the National Economy.

Table 4.1 shows some statistics on the errors in the forecasts of changes in GDP made at different points in time. The first forecast was prepared in the third quarter in the previous year and the last in the fourth quarter of the present year when available information includes national accounts data for the two first quarters.

As in the previous sections forecast errors are always the difference between the relevant forecast and the most recent estimate of the variable by Statistics Iceland. It is to be expected that in the future there will be some revisions of data used in this paper, especially of the most recent estimates.

Table 4.1

Errors in forecasting changes in GDP in year t

Time of forecasting	Average error (%)	RMSFE	P-value one-tail	Rank sum	Theil's U_2	RMSFE/ Stdev.	RMSFE/ Stdev. GNI
(t-1)Q3	-1.231	2.221	0.094	10	0.458	0.901	0.866
(t-1)Q4	-1.436	2.321	0.038	4	0.478	0.942	0.905
tQ1	-1.755	2.146	0.004	0	0.442	0.871	0.837
tQ2	-1.305	1.938	0.023	15	0.399	0.786	0.755
tQ3	-1.502	1.684	0.021	6	0.347	0.683	0.657
tQ4	-1.449	1.815	0.005	0	0.374	0.736	0.708

The table is based on seven observations (2001-2007) on errors in forecasts published in the third quarter of the previous year ((t-1)Q3). There are six observations (2000-2005) on errors in forecasts published in the third quarter in the current year as we treat the change in the frequency of the publication of the Monetary Bulletin that took place in 2006 as a drop in the third quarter publication. There are eight (2000-2007) observations on forecasts published at the other points in time within the year.

In all cases the average errors are negative and it is noteworthy that these errors don't seem to decrease as time passes and more information is gathered. Other indicators of forecasting accuracy like RMSFE, Theil's U_2 and normalised RMSFEs show that later forecasts which are based on more information are better as is to be expected.

If there are six observations then the critical value for one-tailed Wilcoxon's rank sum test is 2 when $\alpha = 0.05$. When there are seven observations the critical value is 3 and it is 5 when there are 8 observations. This shows that in spite of very few observations the negative bias in the forecasts are significant in three out of six cases.

As noted above the (t-1)Q3 (third quarter of the previous year) forecasts are comparable to NEI's forecasts in the National Budget. The statistics on forecast errors reported in Table 4.1 indicate large improvements compared to NEI's forecasts during 1981-2002 (see Table 3.1 above). There is also an improvement if CBI's forecasts are compared to NEI's forecasts for the period 1994-2002. But if CBI's forecasts are compared to those that NEI did for the period 1995-2002 the average error (-1.23 vs. -1.33), RMSFE (2.22 vs. 1.99), Theil's U_2 (0.46 vs. 0.48) and normalised RMSFEs (0.90 and 0.87 vs. 0.88 and 0.88) are similar.

Comparing CBI's tQ1 (first quarter of the year that the forecast applies to) forecasts to NEI's forecasts in the National Economy indicate similar forecasting accuracy in terms of average error (-1.76 vs. -0.53), RMSFE (2.15 vs. 1.63), Theils U_2 (0.44 vs. 0.39) and normalised RMSFEs (0.87 and 0.84 vs. 0.72 and 0.72).

Table 4.2 shows statistics for the errors in CBI's forecasts of changes in private consumption.

Table 4.2

Errors in forecasting changes in private consumption in year t

Time of forecasting	Average error (%)	RMSFE	P-value one-tail	Rank sum	Theil's U_2	RMSFE/ Stdev.
(t-1)Q3	-1.444	4.204	0.219	16	0.667	0.854
(t-1)Q4	-0.908	3.696	0.262	15	0.586	0.751
tQ1	-1.546	3.567	0.122	18	0.566	0.724
tQ2	-0.902	3.449	0.248	13	0.547	0.700
tQ3	-0.795	2.155	0.243	7	0.342	0.438
tQ4	0.035	1.128	0.532	20	0.179	0.229

The table shows that the forecasts improve as time passes and more information becomes available. Comparing the (t-1)Q3 forecasts in Table 4.2 to the NEI's forecasts for changes in consumption in the National Budget for the period 1995-2002 shown in Table 3.3 above shows that NEI's forecasts were somewhat better during this short period of time. If we compare CBI's forecasts with NEI's forecasts for

1981-2002 CBI's forecasts are better. The average errors are negative in all cases but not significantly so in the shorter periods.

Table 4.3 shows indicators for accuracy in CBI's forecasting of changes in government consumption.

Table 4.3

Errors in forecasting changes in public consumption in year t

Time of Forecasting	Average error (%)	RMSFE	P-value one-tail	Rank sum	Theil's U_2	RMSFE/ Stdev.	RMSFE rand. walk
(t-1)Q3	-1.173	1.550	0.025	13	0.417	1.324	1.438
(t-1)Q4	-1.005	1.274	0.006	8	0.343	1.088	1.357
tQ1	-1.118	1.407	0.005	7	0.378	1.202	1.016
tQ2	-1.018	1.311	0.007	8	0.352	1.119	1.110
tQ3	-0.888	1.230	0.067	10	0.331	1.051	1.129
tQ4	-0.693	1.364	0.081	3	0.367	1.165	1.319

The table shows that there is strong evidence of a negative bias in forecasting of goverment consumption. This bias is significant on usual signicance levels according to the t-test but not quite signifcant according to the rank-sum test. Theil's U_2 shows that the forecasts are much better than forecasting zero growth every time. It is worrying that forecasting accuracy does not seem to improve much as time passes and more information becomes available.

The RMSFE standardised with the standard deviations of the variable is greater than unity indicating that forecasting constant growth near the average growth is better than CBI's forecasts. The last column in Table 4.3 shows RMSFEs when the most recent change in growth in government consumption known at the time of forecasting is used as a forecast. The RMSFEs from this forecasting method, which is optimal if the growth follows a random walk process, are actually lower than the RMSFEs of CBI's forecasts, except for the forecasts made in the fourth quarter of the previous year.

CBI has published forecasts for the components of fixed investments. Table 4.4 shows indicators for the accuracy in the forecasting of changes in business fixed investments.

Table 4.4

Errors in forecasting changes in business fixed investments in year t						
Time of forecasting	Average error, %	RMSFE	P-value one-tail	Rank sum	Theil's U_2	RMSFE/ Stdev.
(t-1)Q3	-12.707	18.778	0.046	12	0.637	0.645
(t-1)Q4	-13.109	18.174	0.014	15	0.616	0.624
tQ1	-5.303	9.870	0.068	11	0.335	0.339
tQ2	-5.053	8.916	0.056	11	0.302	0.306
tQ3	-1.724	3.862	0.196	8	0.131	0.133
tQ4	-3.690	6.653	0.061	10	0.226	0.228

The table shows that even if the average errors are large and frequently significant or nearly significant, these errors decline as time passes and more information becomes available and both Theil's U_2 and standardised RMSFE are well below unity.

Table 4.5 shows indicators of accuracy in the forecasting of changes in residential housing investments.

Table 4.5

Errors in forecasting changes in residential housing investments in year t						
Time of forecasting	Average error, %	RMSFE	P-value one-tail	Rank sum	Theil's U_2	RMSFE/ Stdev.
(t-1)Q3	-6.432	7.715	0.011	6	0.612	2.091
(t-1)Q4	-7.465	8.914	0.002	0	0.707	2.416
tQ1	-4.303	9.284	0.104	9	0.736	2.516
tQ2	-3.853	7.549	0.080	3	0.599	2.046
tQ3	-4.245	4.719	0.019	6	0.374	1.279
tQ4	-4.278	5.553	0.008	0	0.440	1.505

The table shows that there is evidence of significant negative bias in the forecasts. There is also surprisingly small improvements in the forecasts over time. Theil's U_2 is well below unity indicating good forecasts but standardised RMSFE is well above unity indicating that the forecasts are not that good. When the variable that is forecasted is growing very fast, as is the case with residential housing investment here, Theil's U_2 comparison with zero growth makes it unsuitable as a measure of forecasting accuracy.

Table 4.6 shows indicators of accuracy in forecasting of changes in government investments.

Table 4.6

Errors in forecasting changes in public investments in year t						
Time of forecasting	Average error, %	RMSFE	P-value one-tail	Rank sum	Theil's U_2	RMSFE/ Stdev.
(t-1)Q3	-1.920	20.600	0.419	18	1.210	1.161
(t-1)Q4	-6.464	21.760	0.219	14	1.278	1.226
tQ1	-7.877	21.980	0.172	14	1.291	1.239
tQ2	-6.814	22.344	0.212	22	1.313	1.259
tQ3	-3.660	19.037	0.361	11	1.118	1.073
tQ4	-6.052	19.284	0.205	12	1.133	1.087

The table shows that the errors are large and hardly decreasing over time but not significantly biased. Both Theil's U_2 and standardised RMSFEs are well above unity. As Theil's U_2 is above unity forecasting that the change in government investments was always zero would have resulted in better forecasts than CBI's forecasts in terms of RMSFE.

Table 4.7 shows indicators of accuracy in the forecasting of changes in total fixed investments.

Table 4.7

Errors in forecasting changes in fixed investments in year t						
Time of Forecasting	Average error, %	RMSFE	P-value one-tail	Rank sum	Theil's U_2	RMSFE/ Stdev.
(t-1)Q3	-8.888	12.830	0.041	12	0.644	0.680
(t-1)Q4	-11.029	13.963	0.006	15	0.701	0.740
tQ1	-6.129	8.928	0.021	6	0.448	0.473
tQ2	-4.892	7.902	0.038	20	0.397	0.419
tQ3	-2.843	4.285	0.089	4	0.215	0.227
tQ4	-4.660	6.200	0.010	0	0.311	0.328

The table shows that there is evidence of significant negative bias in the forecasts. It also shows that the forecasting accuracy improves over time and that both Theil's U_2 and standardised RMSFE are well below unity. Comparing the accuracy of CBI's forecasting in the third quarter of the previous year to similar forecasts by NEI for 1995-2002 in Table 3.3 above show that the CBI's forecasts are somewhat better in terms of RMSFE and much better in terms of Theil's U_2 and standardised RMSFE.[12]

Table 4.8 show errors in CBI's forecasting of changes in the national expenditure.

[12] It is, of course, possible to argue that during 2001-2007 an unusually large parts of fixed investments were known in advance. The same is true for the latter part of the 1995-2002 period.

Table 4.8

Errors in forecasting changes in national expenditure in year t						
Time of forecasting	Average error (%)	RMSFE	P-value one-tail	Rank sum	Theil's U_2	RMSFE/ Stdev.
(t-1)Q3	-2.794	4.179	0.049	11	0.520	0.620
(t-1)Q4	-3.091	4.352	0.016	6	0.541	0.646
tQ1	-2.409	3.337	0.014	6	0.415	0.495
tQ2	-1.847	2.930	0.034	4	0.364	0.435
tQ3	-1.208	1.772	0.081	3	0.220	0.263
tQ4	-1.291	1.668	0.007	8	0.207	0.248

There is evidence of significant negative bias in the forecasts but the accuracy improves over time and both Theil's U_2 and standardised RMSFE are well below unity.

Table 4.9 shows indicators of accuracy in forecasting of changes in exports.

Table 4.9

Errors in forecasting changes in export in year t						
Time of forecasting	Average error, %	RMSFE	P-value one-tail	Rank Sum	Theil's U_2	RMSFE/ Stdev.
(t-1)Q3	-1.826	5.920	0.244	8	0.704	0.898
(t-1)Q4	-1.283	5.558	0.275	7	0.661	0.843
tQ1	-2.583	5.715	0.111	10	0.680	0.867
tQ2	-1.864	3.970	0.101	1	0.472	0.602
tQ3	-2.335	2.452	0.011	6	0.292	0.372
tQ4	-2.508	5.296	0.099	8	0.630	0.803

The table shows some evidence of negative biases. It also shows some improvements in forecasting accuracy as time passes, except for the forecasts made in the fourth quarter of the present year. This is though largely because of a very large error in the forecast for 2007. The forecasts in the two last quarters of the previous year and in the first quarter of the present year are fairly poor both according Theil's U_2 and standardised RMSFEs.

Comparing forecasts made in the third quarter of previous year in Table 4.9 to similar forecasts made by NEI during 1995-2002 and shown in Table 3.3 above show that measured by Theil's U_2 and standardised RMSFE CBI's forecasts are better.

Both NEI and CBI used estimated equations to forecast some components of export while large parts were forecasted exogenously from the catch quotas that have been determined in advance and from the planned production of aluminium and ferro-scilicon.

Table 4.10 shows indicators for accuracy in CBI's forecasts of changes in imports.

Table 4.10

Errors in forecasting changes in import in year t						
Time of forecasting	Average error (%)	RMSFE	P-value one-tail	Rank sum	Theil's U_2	RMSFE/ Stdev.
(t-1)Q3	-5.859	8.574	0.044	4	0.635	0.716
(t-1)Q4	-5.697	8.333	0.021	3	0.617	0.696
tQ1	-4.685	6.914	0.022	3	0.512	0.578
tQ2	-3.754	7.002	0.068	2	0.519	0.585
tQ3	-1.931	4.598	0.211	1	0.341	0.384
tQ4	-2.129	4.246	0.085	3	0.315	0.355

There is clear evidence of significant negative biases in the forecasts, but the forecasts improve over time. RMSFE in the third quarter of the previous year, (t-1)Q3, is almost the same as in NEI's forecasts for 1995-2002 shown in Table 3.3 above. Both Theil's U_2 and standardised RMSFE are well below unity and somewhat lower than those for NEI's forcasts for 1995-2002.

To complete the picture we report in Table 4.11 the correlation coefficients between errors in forecasting of the different variables.

Table 4.11

	Correlations coefficients of forecast errors:						
	GDP	C	G	I	X	M	C+G+I
GDP	1.000	0.464	-0.412	0.010	0.809	-0.012	0.078
C	0.464	1.000	-0.378	0.163	0.225	0.631	0.594
G	-0.412	-0.378	1.000	-0.472	-0.086	-0.278	-0.418
I	0.010	0.163	-0.472	1.000	-0.521	0.757	0.861
X	0.809	0.225	-0.086	-0.521	1.000	-0.428	-0.432
M	-0.012	0.631	-0.278	0.757	-0.428	1.000	0.971
C+G+I	0.078	0.594	-0.418	0.861	-0.432	0.971	1.000

The correlation between errors in forecasting of imports and consumption is quite high but still a lot lower than in Table 3.4 above which shows the correlations of errors in NEI's forecasts. The correlation between errors in forcasting of imports and investments is also high but a bit lower than the same correlation in NEI's forecasts. The correlations between consumption and invesments is quite low (0.163) while it is quite high in NEI's forecasts (0.730 when forecasts for 1995-2002 are considered).

Table 4.12, finally, reports the covariances of the forecast errors:

Table 4.12

	Covariances of forecast errors:						
	GDP	C	G	I	X	M	C+G+I
GDP	4.125	4.009	-0.979	0.220	9.961	-0.174	0.553
C	4.009	18.112	-1.885	7.248	5.790	18.943	8.818
G	-0.979	-1.885	1.371	-5.774	-0.613	-2.291	-1.707
I	0.220	7.248	-5.774	109.126	-33.007	55.768	31.363
X	9.961	5.790	-0.613	-33.007	36.718	-18.285	-9.116
M	-0.174	18.943	-2.291	55.768	-18.285	49.683	23.858
C+G+I	0.553	8.818	-1.707	31.363	-9.116	23.858	12.155

5. Errors in first releases of national account data from Statistics Iceland

In the previous section the errors in the forecasts were always the differences between the most recent figures from Statistics Iceland and the forecasts. When analysing forecast errors it is important to remember that data from Statistics Iceland tend to change over time, and usually they increase. There are considerable differences between the actual changes in macroeconomic variables used in Felixson and Gudmundsson (1988) and those used in the present paper. Even if Katrín Ólafdsóttir (2006) is a very recent paper the estimates of the actual changes of the variables used in her paper are different from those used in this paper. It is therefore quite probable that the figures for 2007 that we have been using here as “final data” will be revised at some later date.

It is possible to measure the accuracy of the first releases of data from Statistics Iceland in the same way as we have been measuring the accuracy of the forecasts from the NEI and the CBI by treating the first releases as forecasts. The outcomes for the period 2000-2006 are shown in Table 5.1.

The table shows that the negative biases in the first releases of data on changes in GDP and in national expenditures are close to being significant at the 5% level. In most cases both Theil’s U_2 and standardised RMSFE are well below unity and it is very low in the case of private consumption and imports. But there are some noteable exceptions: changes in residential housing investments and changes in government investments score quite high on Theil’s U_2 even if they are well below unity and for residential housing investments the RMSFE/Stdev. is almost 2 indicating that forecasting constant growth near the actual average growth over the whole period would have produced much better forecasts than the first releases.

Table 5.1

"Errors" when first figures from Statistics Iceland are used for forecasting						
	Average error (%)	RMSFE	P-value one-tail	Rank sum	Theil's U_2	RMSFE/ Stdev.
GDP	-0.942	1.564	0.057	4	0.314	0.589
National exp.	-0.727	1.526	0.116	1	0.178	0.233
Private consumption	-0.005	0.484	0.491	22	0.074	0.091
Public consumption	-0.393	1.347	0.242	7	0.357	1.070
Business investments	-4.191	8.577	0.110	10	0.286	0.317
Residential housing inv.	-3.337	8.097	0.155	17	0.646	2.045
Public investments	-0.152	12.488	0.489	11	0.689	0.652
Gross fixed investments	-2.997	7.195	0.152	2	0.350	0.412
Export	-0.731	1.719	0.147	14	0.295	0.371
Import	-0.430	1.076	0.163	9	0.075	0.087

As can be seen by comparing data in Table 5.1 to data in Table 4.5 above the forecasts of residential housing published by CBI during the latter half of the year were better forecasts of the final data in terms of Theil's U_2 and RMSFE/Stdev. than the first releases from Statistics Iceland published few months after the year for which the growth in residential investment is to be forecasted.

That the first releases of output (GDP) are negatively biased seems to be in line with what can be observed in other countries (see e.g. Öller and Ballot, 1999). Aruoba (2005) finds that revisions to national account data for the US depend on the state of the business cycle.

6. Conclusions

For much of the discussion above it is necessary to keep in mind that it was based on few observations. In such situations small changes in the sample, even the inclusion or exclusion of one observation, may have large influence on the results. Much of the discussion was in terms of analysis and comparisons involving NEI's forecasts for the period 1995-2002. We pointed out that we did this knowing that NEI's forecasting performance in 1994-2002 was substantially worse than during the 1995-2002 period.

We have shown above that there have been some improvements over time in forecasting of changes in GDP and private consumption in Iceland. The RMSFE of NEI's forecasting for GDP and private consumption is substantially lower for the period 1995-2002 than in earlier periods. These forecasts also score better on Theil's U_2 and marginally better on the RMSFE/St.dev. measure.

We noted that in earlier periods NEI's forecasts prepared in March/April of the year were surprisingly often no better than forecasts made 6 months earlier. This anomalie disappears in later periods.

For export and import no improvement can be seen and the forecasting of investment had actually higher RMSFE in 1995-2002 than in earlier periods. As the volatility was also higher in 1995-2002 there are only small differences in RMSFE/St.dev.

Forecasts for changes in GDP and private consumption published by the CBI for 2000-2007 at similar time as the forecasts that NEI made in September in the previous year were found to be roughly as good as NEI's forecasts for the period 1995-2002. As time goes on and more information becomes available CBI's forecasts of these variables improve.

Comparing forecasting of changes in investment, export and imports by NEI in 1995-2002 to those published by CBI for 2000-2007 seems to give CBI's forecasts an advantage.

In most cases CBI's forecasts improve as time goes on and more information becomes available as is to be expected. There are though some exceptions to this rule. There is no improvement in the forecasts for changes in government consumption and government investments between forecasts made in the third quarter of the previous year to the fourth quarter of the year that the forcast applies to. We also showed that using the last known growth rate in government consumption at the time of forecasting as forcast for next year's growth in government consumption improves on the actual forecasts published by the CBI.

We documented negative errors in the first releases of macroeconomic data from Statistics Iceland. For changes in GDP the negative bias was practically significant (p-value 5.7%) even if the observations are very few. The analysis showed that in the case of changes in government consumption and government investments there are large errors in forecasting when first releases of data are used as forecasts of "final" data. The forecasting performance of the first releases of data on residential housing investments was also poor.

It is worrying that there is a clear and statistically significant bias in economic forecasting of GDP in Iceland. The same tendency can be observed in most forecasting of macroeconomic variables in Iceland. NEI's forecasts have this negative bias as well as CBI's more recent forecast. It is not difficult to point to some reasons why public institutions like the CBI and the NEI might make negatively biased forecasts. It has e.g. been their policy not to include large scale investments until they been approved by the government and Parliament. These investment are usually known earlier and it would therefore have been possible to improve the forecasts by including an estimate of these investments, possibly with a wheight indicating the probability that they are approved by the authorities and implemented. It is also difficult for public institutions to have completely independent views on declarations by governments on the growth of government consumption and government investments or if the catch will exceed the allocated quotas and official estimates of catches outside of the quota system. Forecasting of wages can also be a sensitive issue in macroeconomic forecasts perpared by institutions that are important economic actors as well. It seems reasonable to expect that all these restrictions contribute to making the forecasts of changes in GDP lower than they would otherwise be and so create a negative bias in the forecasting. Assumptions that the exchange rate and the policy rate are unchanged or change relatively little during the forecast horizon can also have contributed to the bias. In principle assumptions of unchanged exchange rate or unchanged policy rate should not necessarily produce biases in the forecasts but they may though do so if the sample is small, covering one business cycle or only a part of one. The periods that we have focussed on, 1995-2002 and 2000-2007 are period of mainly fast growth where both the policy rate and the exchange rate could be expected to increase.

Some of the arguments above should be relevant for forecasting in other countries than Iceland. Biases in forecasting seems though to be an exception rather than the rule in other countries. Öller and Barot (1999) test for bias in forecasting of changes in GDP in 21 OECD countries and find a signficant bias in only 2 cases and Anderson et al. (2007) do not find evidence of bias in forecasting of changes in GDP in Sweden by two public institutions and a private institution. Timmermann (2006) analysis IMF forecasts for a large group of countries and finds more evidence for positive bias than for negative bias, especially in the third world. Elliott et al. (2008) find some evidence of significant negative biases in forecasting of changes in GDP in the US.

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