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Errors in macroeconomic forecasts

As the saying goes, it is difficult to predict – especially the future. Nonetheless, we must attempt to predict the future if we intend to respond in time and affect the course of the events to come. Weather forecasts, forecasts about fish stocks, macroeconomic forecasts, population projections, and forecasts of future traffic patterns are examples of predictions that are made on a regular basis. Although a great deal of work lies behind these forecasts – for it is important that they be as well prepared as possible – they are usually subject to significant uncertainty. Those who prepare forecasts and those who use them should therefore make a regular practise of scrutinising forecast errors in an attempt to learn from them. In Iceland, it is increasingly common that those who prepare macroeconomic forecasts publish previous forecasts together with the most recent actual figures concerning past periods. Both the Economic Department of the Ministry of Finance and the Central Bank do this on a regular basis. It is less common that a methodical review of these errors is carried out in an effort to determine how accurate the forecasts are, whether they are improving as time passes, and whether they contain systematic errors.[2]

Methods for assessing forecast quality

At first perusal, assessing forecast quality might seem simple. It can be done by comparing forecast values with actual measurements and assessing the quality of the forecast in terms of the size of the error. This is correct, of course, but many problems arise when an attempt is made to draw conclusions based on such a comparison. Naturally, it is not possible to draw broad-based conclusions from the outcome of a single forecast. When uncertainties exist, chance will always play some part in determining the success of individual forecasts; therefore, it is necessary to examine forecast errors over time in order to draw conclusions concerning forecast quality. It is then necessary to find a method for quantifying several forecast errors with a single figure. The most common method is to examine the average of the square of the errors (root mean square forecasting error, or RMSFE), but the average of the absolute value of the errors is also used.

The forecast with the smallest average error is presumably the best one. However, it could arise that one forecast appears best in terms of the RMSFE, while examining the average of the absolute values of forecast errors produces a different result. It is also possible that the forecast method that produces the best forecast for the cur-

rent year may prove much less effective in forecasting for the following year.

Although it is convenient to assume that a decrease in the average error measured by RMSFE is an indication that forecasts are improving, this is not necessarily the case. It could be that forecasting has become easier due to changed conditions. For example, recent studies show that the variability of economic aggregates has diminished in many leading industrial nations. A similar development has taken place in Iceland as well.[3] This reduced variability has made it easier for economists to carry out forecasting. However, the errors in forecasts using some naïve forecasting method have decreased more than errors in forecasts using more sophisticated methods; thus the difference in quality between sophisticated and naïve forecast methods has diminished as well.

From a pure theoretical point of view, the best forecasting method is that which utilises all significant information that is known at the time the forecast is prepared, so as to minimise errors. Though this criterion is certainly important, it is not easy to use it in evaluating a given forecasting method because it is usually difficult to determine whether all significant information has been utilised. Therefore, the evaluation of forecasting methods has focused either on examining the properties of errors (mainly examining whether there is a significant bias or autocorrelation in the errors and, if so, improving the forecasts by correcting for it), on comparing the errors generated by a given forecasting method with those generated by some naïve method, or on comparing the errors with some measure of volatility in the variable being forecast.

Errors in National Economic Institute forecasts

The National Economic Institute is the only Icelandic institution that has carried out forecasting of changes in macroeconomic aggregates in Iceland for long enough that it is possible to conduct an in-depth appraisal of its forecasts. The Institute prepared forecasts of changes

Table 1 Errors in National Economic Institute forecasts

Unit %	September forecast		Standard deviation Change in GDP	Standard deviation Change in National income	March forecast	
	Mean error	RMSFE			Mean error	RMSFE
1974-1986	-2.95	3.76	3.14	4.83	-3.05	4.40
1987-2002	-1.57	2.84	3.05	3.59	-1.12	2.24
1974-1994	-2.52	3.66	3.43	4.65	-2.54	3.75
1995-2002	-1.32	1.99	2.25	2.26	-0.53	1.63
1974-2002	-2.19	3.28	3.12	4.14	-1.99	3.24

3. This is discussed in the paper by Ásgeir Daníelsson entitled "The great moderation, Icelandic style," which is forthcoming as part of the Central Bank of Iceland Working Papers series.

in macroeconomic aggregates from 1974-2002. Table 1 shows the measurements of errors in the National Economic Institute's forecasts for several periods. In the first two columns are the mean error and the RMSFE for the forecasts of changes in GDP. The forecasts were prepared in the fall of the previous year.[4]

The last two columns contain the same information about errors in the forecasts prepared in March or April of the year to which the forecast pertains.

Column 3 of Table 1 indicates the variability in GDP during the period concerned. The table shows that the standard deviation of proportional changes in GDP has diminished. It is quite clearly less during the period 1995-2002 than it was prior to that time. Column 4 shows that the variability in national income has diminished even further.

An examination of forecast errors reveals that there has been a strong tendency to forecast too little output growth. Testing to determine whether this bias is significant reveals that it is significant in all instances specified in Table 1, except for the period 1995-2002, when there were relatively few observations. However, no significant autocorrelation was found in the errors in any period.

Table 1 shows that, in several instances, the forecasts carried out in March contain more errors than those prepared six months prior. Other things being equal, forecasts that are prepared later – when a greater amount of information is available – can be expected to be better.

In Table 1, it can be seen that the errors in the National Economic Institute forecasts for changes in GDP are smaller during later periods. This could indicate that forecasting methods have improved,[5] but it could also be due to lesser variability. If the ratio of RMSFE (columns 2 and 6 in the table) to the standard deviation in changes in GDP and national income (columns 3 and 4) is used as a criterion, the quality of March forecasts has improved substantially in both cases. The September forecasts are better in terms of changes in GDP, while there is no difference in terms of changes in national income.

An examination of the National Economic Institute's September forecasts of changes in private consumption reveals that the errors are significantly negative in most cases and, although the errors diminish substantially, they diminish little more than does the variability in the aggregate being forecast. Errors in forecasts of investment, exports, and imports are also negative; however, the bias does not reach the 5% significance level, although the difference is small for the longest periods.

Errors in Central Bank forecasts

The Central Bank has included macroeconomic forecasts in its *Monetary Bulletin* ever since the first issue was published in November 1999. During the first years, the National Economic Institute prepared these forecasts. Following this was a period during which the staff of

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4. These forecasts were published in the national budget issued by the Office of the Prime Minister.

5. For example, the Institute began to use an econometrically estimated model in its forecasting in 1989..

Table 2 Errors in Central Bank forecasts

Unit % Forecast prepared:	GDP Mean error	 RMSFE	Private consumption Mean error	 RMSFE	Public consumption Mean error	 RMSFE
(t-1) Q3	-1.231	2.221	-1.444	4.204	-1.173	1.550
(t-1) Q4	-1.436	2.321	-0.908	3.696	-1.005	1.274
t Q1	-1.755	2.146	-1.546	3.567	-1.118	1.407
t Q2	-1.305	1.938	-0.902	3.449	-1.018	1.311
t Q3	-1.502	1.684	-0.795	2.155	-0.888	1.230
t Q4	-1.449	1.815	0.035	1.128	-0.693	1.364

the Bank's Economics Department carried out the forecasts using the National Economic Institute model. Since the first quarter of 2006, however, the Central Bank has used its own Quarterly Macroeconomic Model (QMM) to prepare its forecasts.

In examining forecasts, it is very important to compare forecasts that are similar in terms of underlying information. This paper classifies the forecasts in *Monetary Bulletin* by date of publication. This classification means that the number of tests for errors in specific types of forecasts is very small, or 7-8.

Table 2 shows the mean forecast error and the RMSFE for the forecasts of changes in GDP, private consumption, and public consumption for the period 2000-2007. The top row shows the errors in the forecasts that were published in the third issue of *Monetary Bulletin* in the year prior to that to which the forecast pertains. The second row shows the errors in the forecasts that were published in the *Monetary Bulletin* issue immediately following, and so on. The bottom row shows the errors in the forecasts that were published in the fourth issue of Monetary Bulletin in the year to which the forecasts pertain.

Table 2 shows that the mean error was negative in all of the forecasts except one; that is, the actual growth in the aggregates was greater than was projected in all forecasts except one. Despite the small number of observations, the negative bias in the forecast for GDP is significant in many instances. The negative bias in the forecast for private consumption, however, proved not to be significant. In both instances, the RMSFE diminishes over time, as a greater amount of information becomes available. The reduction is greatest in the forecasts of changes in private consumption.

Some observers might conclude that it is rather simple to forecast public consumption and public investment, as these are decided in advance in national and local government budgets. In Tables 2 and 3, which illustrate the errors in these forecasts, it can be seen that the mean error in the public consumption forecast is negative. Although it is only negative by approximately 1%, this bias is significant because of the small variability of the error.

A simple forecast that always allows for unchanged public consumption is of extremely poor quality.[6] On the other hand, the method that predicts that public consumption will change as it is estimated to

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6. This means that the public consumption forecast is considered good in terms of the value called Theil's U.

Table 3 Errors in Central Bank forecasts

Unit % Forecast prepared:	Public investment		Exports		Resident. investment	
	Mean error	RMSFE	Mean error	RMSFE	Mean error	RMSFE
(t-1) Q3	-1.920	20.600	-1.826	5.920	-6.432	7.715
(t-1) Q4	-6.464	21.760	-1.283	5.558	-7.465	8.914
t Q1	-7.877	21.980	-2.583	5.715	-4.303	9.284
t Q2	-6.814	22.344	-1.864	3.970	-3.853	7.549
t Q3	-3.660	19.037	-2.335	2.452	-4.245	4.719
t Q4	-6.052	19.284	-2.508	5.296	-4.278	5.553

have changed in the year immediately preceding[7] is more accurate than the official forecast.

The mean error in the forecasts of public investment is negative; however, the variability is great enough that the bias is not significant. These forecasts are of very poor quality; actually, they are so poor that forecasts assuming that changes in public investment would always be zero would have yielded a smaller error than did the actual forecasts, which were based largely on information from public entities. It is also interesting to note that neither public consumption forecasts nor those for public investment improve to any marked degree when further information becomes available.

An examination of errors in forecasts of exports and residential investment reveals that the mean error has been negative – often significantly negative. This is particularly the case with forecasts of residential investment. Errors in export forecasts diminish as time passes and further information becomes available. There is little difference, however, between the forecasts made in the third quarter of the previous year and those from the first quarter, when the forecasts are little better than forecasts predicting no change in quantities of goods exported.

Table 3 shows that errors in forecasts of residential investment diminish very little over time and that the RMSFE is very high in comparison with the standard deviation for changes in this variable.

Errors in first releases of data from Statistics Iceland

Table 4 illustrates the difference between the first figures from Statistics Iceland and the most recent figures, which were published in March 2008. These first releases can be viewed as forecasts of the final

Tafla 4 Errors in first releases of data from Statistics Iceland

Unit %	Mean error	RMSFE
GDP	-0.942	1.564
Private consumption	-0.005	0.484
Public consumption	-0.393	1.347
Residential investment	-3.337	8.097
Public investment	-0.152	12.488
Total investment	-2.997	7.195
Exports	-0.731	1.719
Imports	-0.430	1.076

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7. This method gives the best forecasts when the aggregate being projected follows a random walk trajectory.

figures. Table 4 shows the mean error and RMSFE of these forecasts for the period 2000-2006.

As Table 4 illustrates, the mean error is always negative. Despite the small number of observations, the negative bias in the forecasts of changes in GDP approaches the 5% significance level. The bias in the forecasts of residential investment is considerable but not significant; however, the RMSFE is large. Although the mean error in the public investment forecasts is small, the RMSFE is large for these forecasts as well.

Conclusion

It is worth noting that there have been negative biases in various macroeconomic forecasts in Iceland. In many instances – particularly in forecasts of GDP growth – the negative bias is significant. A bias of this type is not common in forecasts prepared by corresponding parties abroad; therefore, it is difficult to explain it here in Iceland. One contributing factor may be the conservatism surrounding the treatment of investments in the power and aluminium sectors, which are not included in forecasts until they have been formally approved. Furthermore, it is difficult for public institutions to deviate substantially from government estimates for public consumption, fish catches, etc.

It is appropriate to reiterate that the findings concerning forecasts published by the Central Bank are based on relatively few observations. It is also a possibility that the rapid economic growth during the period 2000-2007 affects the results; for example, the negative bias in the forecasts. For this reason, it may be too early to begin to correct for the bias by adding a measured bias to that derived from the forecasts using current methods.