Quarterly statistics often exhibit regular seasonal variations. Unemployment, for instance, is lower during the summer than in winter, other things being equal. Private consumption generally peaks in the fourth quarter of the year and bottoms out in the first quarter. That being the case, a quarter-on-quarter surge in private consumption in Q4, followed by a drop in Q1 of the following year, says little about underlying economic developments.

The idea behind seasonal adjustment of economic data is to attempt to quantify the seasonal fluctuations and adjust for them to obtain a series that better reflects underlying economic developments and facilitates assessment and interpretation of those developments.

Alternative methods of assessing seasonal fluctuations in GDP

The seasonal fluctuation in a specified time series is often irregular, and most data contain irregular items such as measurement errors. As a result, it is often difficult to assess seasonal patterns in the data. Most likely, such estimations are more difficult in a small economy like Iceland, where irregular items such as large investments by individual companies and the timing of imports and exports can have a proportionally strong impact on measured variables during individual periods of time.

In estimating seasonal fluctuations in GDP, it is possible to choose the direct approach, which measures the seasonal fluctuation directly from measured GDP figures, or the indirect approach. According to the indirect approach, fluctuations in subcomponents of GDP are estimated, adjustments are made, and seasonally adjusted GDP is then calculated from the seasonally adjusted subcomponents, using the same method as is used to calculate measured GDP. In Iceland, GDP estimates are based on the expenditure approach; therefore, seasonally adjusted GDP is estimated from seasonally adjusted private and public consumption, investment, inventory changes, and imports and exports.¹

The advantage of the indirect method is that it guarantees that the relationship between seasonally adjusted GDP and seasonally adjusted subcomponents is the same as that between measured GDP and the corresponding measured subcomponents. Therefore, it is easily possible to calculate subcomponents' contribution to GDP growth using the seasonally adjusted data, just as with the unadjusted data. At first perusal, it also seems sensible to conclude that seasonal fluctuations are more regular in the subcomponents than in the aggregate figures and that it is therefore easier to adjust for seasonality in the subcomponents. This is not always the case, however, and sometimes it is difficult to adjust for all seasonal fluctuations in the aggregates using the indirect method.

The main advantage of the direct approach is its simplicity. In addition, it does adjust for all seasonal fluctuations in aggregate figures. Furthermore, it seems to give more stable results and lead to smaller revisions of historical figures than the indirect approach (see, for instance, Rodriguez and Brathaug, 2012).²

The two methods yield very similar results most of the time. They do not always do so, however, and in the case of Iceland the differences in the outcomes are rather striking. In such instances, the Box IV-1

Seasonal adjustment of GDP





- Seasonally adjusted GDP, Statistics Iceland

Source: Statistics Iceland.

Chart 1

Q1/1997 - Q2/2012

GDP

^{1.} The various statistical methods for assessing seasonal fluctuations are not discussed here. These methods can range from a simple regression analysis of seasonal dummies to more complex statistical filters such as X12 and Tramo/Seats. The Central Bank has generally used X12 to assess seasonal fluctuations. This also applies to the assessment of seasonally adjusted GDP with the direct approach used in this Box.

Rodriguez, J., and A. L. Brathaug (2012). Seasonal adjustment: Direct versus indirect approach: Two cases from the Norwegian quarterly national accounts. OECD, STD/ CSTAT/WPNA(2012)23.



Chart 3 GDP and seasonally adjusted GDP Q2/1997 - Q2/2012



Sources: Statistics Iceland, Central Bank of Iceland.



Difference between most recent and earlier figures (%)



Sources: Statistics Iceland, Central Bank of Iceland

question arises of which method is preferable. In this context, it is important to remember that seasonally adjusted data are not measured data in the same sense as unadjusted data; they are the results of statistical filtering of the unadjusted data with a specific goal in mind; that is, facilitating the interpretation of underlying economic developments. Therefore, Rodriguez and Brathaug (2012) argue that, in selecting a method for seasonal adjustment of GDP, it is necessary, first and foremost, to consider how volatile the seasonally adjusted data are and how much they are revised when new data are added. In examining seasonally adjusted data for Norway, Rodriguez and Brathaug find that the indirect method is far from being less effective than the direct approach. As a result, they recommend the use of the indirect approach to adjust for seasonality in Norwegian GDP. Statistics Iceland has also used the indirect approach, in line with guidelines from Eurostat, the EU statistical bureau, concerning seasonal adjustment in the European Economic Area.

Seasonally adjusted GDP

Chart 1 shows developments in constant-price quarterly GDP in Iceland for the periods for which Statistics Iceland has published quarterly national accounts; i.e., from Q1/1997 to the most recent figures in Q2/2012. The chart shows both the unadjusted data and the seasonally adjusted data obtained with the indirect method used by Statistics Iceland. It can be seen that measured data have clear peaks and troughs within each year. The peaks usually occur in Q3 and the troughs in Q1. The unadjusted data also suggest that seasonal fluctuations of GDP changed over this 15-year period; it appears that seasonal fluctuations were somewhat smaller in 2002-2007 than in the periods before and after. The seasonally adjusted data appear, to some extent, to smooth out fluctuations in the measured data, but there are still quite sizeable short-term fluctuations in the seasonally adjusted series. The seasonal adjustment therefore appears not to remove as much variability as could be expected.

As Charts 2 and 3 indicate, the direct approach seems more effective in filtering out short-term fluctuations in measured data. Actually, the two methods yield similar results at the beginning of the period, but from 2005 onwards the results begin to diverge. The difference grows greater over time, with the fluctuations in the seasonally adjusted data tending to diminish if the direct method is used, while they grow larger if the indirect method is used. This is also seen if the standard deviation of the data is compared. For the entire period, the standard deviation of quarterly changes in the seasonally adjusted series was 3.3% using Statistics Iceland's indirect approach and 2.8% using the direct approach. In the latter half of the period, beginning with Q1/2005, the standard deviation is 3.4% in Statistics Iceland's data, as opposed to 2% using the direct method; in other words, the standard deviation is cut almost in half.³

The indirect approach also appears to lead to much larger revisions in seasonally adjusted GDP between publications than the direct approach does. Chart 4 shows the changes in seasonally adjusted GDP in September, when previously published figures were revised slightly.⁴ It is normal that such a revision should lead to a

It is interesting that this difference in the standard deviation of quarterly changes in GDP depending on the method used is much less when seasonally adjusted quarterly changes in nominal GDP are compared.

^{4.} According to revised figures from Statistics Iceland, GDP growth in 2011 was somewhat weaker than previous figures had indicated (2.6% as opposed to 3.1%). Year-2010 GDP growth was unchanged from the previous figures, while year-2008 GDP growth has been revised upwards (1.6% instead of 1.3%) and the contraction in 2009 has been revised downwards (6.6% as opposed to 6.8%). GDP was therefore virtually at the same level in 2011 according to the revised figures and the figures from June.

change in the seasonally adjusted data and that the revision should be greater for the seasonally adjusted figures than for the unadjusted figures, as the statistical filter used for seasonal adjustment changes the figures for previous years even though the unadjusted figures do not change. If changes between publications are measured with the absolute values of the proportional difference shown in Chart 4, it can be seen that the change averaged 0.15% when the direct method is used, slightly more than the average change in the unadjusted data, but about 1.3% in the seasonally adjusted data from Statistics Iceland.

As Chart 5 illustrates, the assessment and interpretation of the business cycle changed dramatically with Statistics Iceland's September revision. Until then, Statistics Iceland's seasonally adjusted figures had indicated a business cycle trough in mid-2010 and the recovery beginning at that time. The same is found when the data are seasonally adjusted with the direct method, no matter whether June 2012 data or the most recent figures from Statistics Iceland are used. According to the most recent seasonally adjusted data from Statistics Iceland, however, the trough of the cycle has shifted an entire year, to mid-2011 (although the difference between the seasonally adjusted data in Q2/2010 and Q2/2011 is only 0.2%).

It is also noteworthy how large the quarter-on-quarter fluctuations in Statistics Iceland's seasonally adjusted figures have become in the past two years. For example, seasonally adjusted GDP contracted by 4.6% quarter-on-quarter in Q2/2011, which corresponds to an annualised contraction of over 17%. In Q3/2011, it grew by 4.3% quarter-on-quarter, or 18% on an annualised basis. This happened again in Q2/2012, when GDP contracted by 6.5% from the previous quarter, or almost one-fourth on an annualised basis. This is an enormous fluctuation, as can be seen by the fact that it equals the output loss sustained by the UK in the wake of the financial crisis – the UK's largest output loss since the Great Depression. In Iceland, however, this happened after output growth had resumed.

Seasonal adjustment in Iceland and neighbouring countries

A comparison of quarter-on-quarter changes in the raw GDP data in Iceland, Denmark, and Norway reveals that variability is similar in the three countries and appears relatively uniform over time. The standard deviation of quarterly changes in measured GDP is about 4.4% in Iceland, 4.3% in Denmark, and 4.5% in Norway. As Chart 6 illustrates, however, there is a significant difference in fluctuations in seasonally adjusted GDP in the three countries. In this instance, the variability of the Icelandic data stands out: the standard deviation of the changes in seasonally adjusted figures is 3.2% in Iceland, as opposed to just over 1% in Denmark and Norway. For some reason, the regular seasonal fluctuation is therefore much greater in Denmark and Norway than in Iceland; therefore, there is much less variability in the seasonally adjusted data for those two countries than for Iceland, even though the quarterly changes in the unadjusted data are similar.⁵

There is also a striking difference between seasonally adjusted figures in Iceland and those in Denmark and Norway when a comparison is made of how effectively the seasonal adjustment reduces the variability of the quarterly data, thereby facilitating the use of the data in analysing underlying developments. The ratio of the standard deviation of seasonally adjusted GDP to the standard deviation of the unadjusted data is 0.75 in Statistics Iceland's figures, as opposed to only 0.2-0.3 in Denmark and Norway. The variability



- Seasonal adjustment, Statistics Iceland

Seasonal adjustment from June, Statistics Iceland

2009

2010

2011

Seasonal adjustment, direct method

2008

Sources: Statistics Iceland, Central Bank of Iceland.

2007

Chart 6

250 2006

Seasonally adjusted quarterly GDP growth in Iceland, Denmark and Norway Q2/1997 - Q2/2012



Sources: Eurostat, Statistics Iceland

Chart 7

Ratio of standard deviation of seasonally adjusted and unadjusted quarterly GDP growth Q1/2002 - Q2/2012



^{5.} It is appropriate to mention in this context that the standard deviation of year-onyear changes and the standard deviation of changes over four quarters show greater variability in Iceland than in Denmark and Norway.

Chart 8 Seasonally adjusted GDP Q2/1997 - Q2/2012



Sources: Statistics Iceland, Central Bank of Iceland.

of seasonally adjusted Statistics Iceland's figures is therefore only slightly less than in the unadjusted data, whereas it is considerably smaller in the seasonally adjusted data in the other two countries. This is even clearer in Chart 7, which shows how the information content of Statistics Iceland's seasonally adjusted figures has gradually diminished and the noise-to-signal ratio has been close to 1 in recent years; that is, the variability of seasonally adjusted quarterly output growth has been almost equal to the variability of quarterly changes in measured GDP. At the same time, the information content of data that are seasonally adjusted using the direct method has gradually increased and the noise-to-signal ratio has approached that in Denmark and Norway.⁶

Conclusion

In sum, it appears clear that the method used by Statistics Iceland to calculate seasonally adjusted GDP in Iceland has serious drawbacks and that the problem has escalated in recent years. Seasonally adjusted data fluctuate widely - and in the recent term, only slightly less than unadjusted data. The most recent revision of data also entailed a major revision of historical data, complicating the assessment of underlying economic developments. Further analysis of the seasonally adjusted data also indicates that there is a statistically significant seasonal fluctuation in Statistics Iceland's seasonally adjusted figures.⁷ This problem does not appear, however, when GDP is seasonally adjusted using the direct method: the information content of the data is enhanced, variability between revisions is considerably reduced, and there are no longer statistically significant seasonal fluctuations in the seasonally adjusted data. It therefore appears more appropriate for Icelandic conditions to use seasonally adjusted GDP data obtained with the direct method. The analysis in this Monetary Bulletin is therefore based on data that have been seasonally adjusted using the direct method, not on the seasonally adjusted data from Statistics Iceland. More specifically, the logarithm of the data is seasonally adjusted using the X12 method, using the Bank's forecast for the period until 2016 to reduce the endpoint inaccuracy in the seasonal filtering. As can be seen in Chart 8, this entails a further reduction in the fluctuations in seasonally adjusted data at the end of the period. For instance, the quarter-on-quarter contraction in Q2/2012 measured 1%, whereas it was over 4% when the direct method is used with Q2 as the last observation. This can be compared to a 6.5% contraction in Statistics Iceland's figures.

^{6.} According to Statistics Iceland's seasonally adjusted data, Iceland appears to be in a class by itself with respect to the high noise-to-signal ratio. However, similar problems can be seen in the seasonally adjusted data on GDP in Ireland, where the ratio averages 0.66 over the period analysed here.

^{7.} Regressing seasonally adjusted quarterly changes in GDP on seasonal dummies rejects the null hypothesis that seasonal fluctuations in the seasonally adjusted data are statistically insignificant (p-value = 0.03). These seasonal fluctuations in Statistics Iceland's seasonally adjusted figures seem to begin appearing in 2005.