

Change in policy for seasonal adjustment of quarterly series

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Some of the Bank's most important series are available in both quarterly and monthly versions. M4, for instance, while compiled from monthly data, is disseminated at both frequencies. So there are different ways in which a seasonally adjusted quarterly series can be produced. It can be derived from the unadjusted quarterly data, as a quarterly series in its own right, or can be derived by taking just the quarterly observations from the monthly seasonally adjusted series. When using nonlinear seasonal adjustment packages such as X-12-ARIMA, the two adjustments are not necessarily the same. Although both approaches have been used by the Bank in the past, in future only the version derived from the monthly series will be produced. This article outlines the reasons behind this new policy, and a short section at the end outlines the other main changes made to the Bank's seasonally adjusted series as a result of the 2007 Annual Review.

Background

In 2004 the Bank switched to using X-12-ARIMA rather than GLAS for the seasonal adjustment of its time series¹. One feature of X-12-ARIMA is that its outputs can be *non-additive*: relationships² between series or time periods that hold in the unadjusted data need not hold in the adjusted data. One example of this arises in the production of quarterly series from underlying monthly data. When quarterly unadjusted M4 is produced from the monthly unadjusted series, the levels correspond at quarter ends, and the flows match over the quarter. (So the flow of unadjusted M4 in 2007 Q1 is equal to the sum of the flows for January, February and March 2007.) However, once the monthly and quarterly series have been seasonally adjusted, these identities do not automatically hold.

There are two established ways to circumvent this problem, other than simply accepting the differences. The first is to apply a constraining procedure to force the monthly and quarterly series to match; the second is not to adjust the quarterly data separately at all, but simply to define the adjusted quarterly series in terms of the monthly series. Since the switch to X-12-ARIMA was made, the Bank has always eschewed the former approach on the grounds of the quality of the resulting seasonal adjustment, but the latter approach is appropriate and indeed has been applied to some series already. The Bank is now adopting this approach to producing the quarterly series wherever possible.

In cases where data are only collected quarterly, such as the Bank's industrial lending series, the only option is to apply X-12-ARIMA to the quarterly series. These series will be unaffected by the change in approach.

Reasons behind the change

There are some arguments for retaining the approach whereby the monthly and quarterly series are adjusted separately. The X-12-ARIMA diagnostics can be assessed for each frequency individually, and there is no risk of residual seasonality emerging in the quarterly series³. Furthermore, there are time series with long runs of quarterly data, but only a few years' worth of monthly observations. In these cases adjusting the quarterly series separately may produce more reliable estimates of the seasonal factors than deriving the series from the monthly versions.

However, the Bank believes that, on balance, there are good reasons to cease separate adjustment, and to derive the quarterly series directly from the monthly versions. The main arguments commending this policy are:

- 1) Users of the data have been confused by the non-additivity: the Bank has received several queries about why levels in the monthly and quarterly seasonally adjusted series do not match.
- 2) Most other central banks use the monthly series to derive the quarterly data where possible. The decision will thus bring the Bank of England into line with international best practice.
- 3) The Bank has, since 2004, included separate tables for its monthly and quarterly series in section A of this publication. The extra quarterly tables are thought to provide little additional value to users, and require extra production resources.
- 4) For each series that the Bank seasonally adjusts, there is work involved in maintaining and

¹ See "Change in Seasonal Adjustment Method to X-12-ARIMA", *Monetary and Financial Statistics*, December 2003: <http://www.bankofengland.co.uk/statistics/ms/artdec03.pdf>.

² For instance, standard accounting identities may not hold in the seasonally adjusted data.

³ It is theoretically possible that a quarterly series which has been derived from a monthly adjusted series could retain some seasonal signal. However, when tests were applied to a sample of Bank series, no examples of residual seasonality were found.

reviewing the regARIMA⁴ models. This policy change will remove the need to review the quarterly series separately.

- 5) The monthly series are likely to contain more information than the quarterly versions, since intra-quarter variations are taken into account. This may mean that the derived quarterly series reveal movements which the separately adjusted series do not (see the household sector M4 example below for more details).

Effects on the data

The main conclusion from the Bank’s recent work was that, for the most part, the choice of seasonal adjustment method had little material impact on the quarterly data. In many cases the two approaches led to indistinguishable results, particularly when annual growth rates were considered. Chart A, for instance, shows the two possible seasonally adjusted quarterly M4 series. Chart B shows the same comparison for approvals for loans secured on dwellings, together with the unadjusted series. In both cases the two seasonally adjusted series are almost identical. These examples are typical of other Bank series.

Chart A: Effect of the change in policy on the annual growth rate of M4

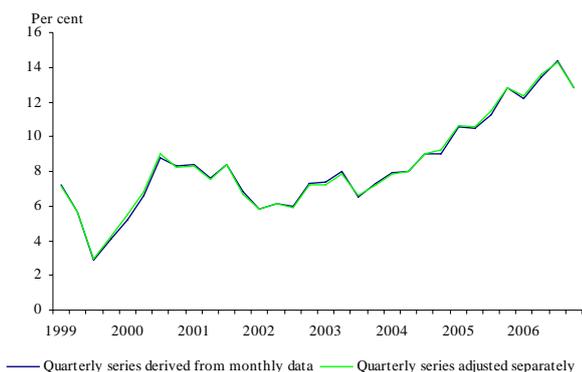
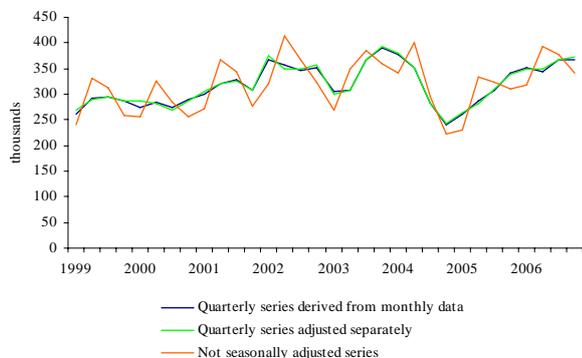


Chart B: Effect of the change in policy on the total number of approvals for loans secured on dwellings

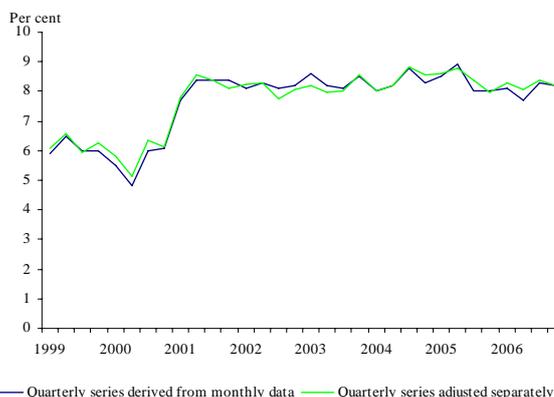


In some cases there can be differences, however. Chart C, for instance, compares the two seasonal adjustments for the twelve-month growth rate of household sector M4. In this case, there are periods for which the series derived

⁴ These are the regression models that are fitted to the time series before adjusting. They are used for forecasting and for identifying outliers.

from monthly data is consistently higher than the separately adjusted one, and vice versa. However, this difference may result from a genuine pattern in the timing of deposit accumulation, which should therefore be reflected in the quarterly data. This illustrates argument (5) above, suggesting that in some cases the monthly series indeed contains more information. If possible, that additional information should be transmitted to the quarterly seasonally adjusted series.

Chart C: Effect of the change in policy on the annual growth rate of household sector M4



Implementation

These changes to seasonally adjusted quarterly data are being introduced in April 2007, when data for 2007 Q1 are first published, and are being applied to all quarters for which monthly data are available. There could be changes to any observation within the timespan for which the data are available monthly, but the changes are not likely to be large, as the charts show. In one sense there is nothing unusual about these changes. Seasonal factors are always recalculated when new data are received, so seasonally adjusted series are often revised on a month-to-month basis as a result.

For a number of the Bank’s series, the monthly data are only available for the recent past and the quarterly data go back much further⁵. In these cases, the quarterly observations for periods before the monthly data are available will retain their current adjustment.

One other minor change, which is being made at the same time, concerns the method for calculating growth rates for quarterly series. Where both monthly and quarterly data are available, the four-quarter growth rate is being redefined to be the same as the twelve-month growth rate, and the one-quarter growth rate is being redefined to be identical to the three-month growth rate. This applies to all quarterly series, including unadjusted ones, and has the advantage of bringing the monthly and quarterly observations of the same underlying series further into line⁶.

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⁵ The sectoral money data are affected in this way, for instance: the quarterly data go back as far as 1963, but the monthly data only begin in 1997.

⁶ For more information about the methods used to calculate growth rates, see http://www.bankofengland.co.uk/mfsd/iadb/notesiadb/growth_rates.htm

Some other minor changes are being made in April following the completion of the 2007 Annual Review of seasonal adjustment. At the time of the switch to X-12-ARIMA, the Bank undertook to review all of its series for seasonality on a regular basis⁷. The 2007 Review, like the 2006 Review⁸, was targeted primarily at series which are published on statistical releases or which were known to be in need of review on the basis of their X-12-ARIMA diagnostics. 92 of the Bank's nearly 300 published seasonally adjusted series were reviewed this year, to assess whether they should continue to be seasonally adjusted, or whether their seasonal adjustment could be improved upon.

As described on the first page of this article, the change in policy for quarterly adjustment has removed the need to review models for quarterly series where underlying monthly data exist. This means that the only quarterly series which were reviewed this year were some mortgage equity withdrawal (MEW) and industrial lending series. For other quarterly series it was only necessary to analyse the diagnostics for the corresponding monthly series.

Of the 92 series that were analysed, 27 were left unchanged following the review. Table 1 below summarises the changes that were made to the remaining series:

Table 1: Number of series changing as a result of the annual review

Change	Number of series
ARIMA model	45
Outliers changed	30
Trading-day variables added	4
Trading-day variables removed	4
Easter effect variable added	20
Easter effect variable removed	1

Four series which were previously seasonally adjusted were found to be insignificantly seasonal when their diagnostics were reassessed. These will now no longer be adjusted. Footnotes have been added to these series on the Bank's Interactive Database to indicate this change.

⁷ See paragraphs 29-30 of "Change in Seasonal Adjustment Method to X-12-ARIMA", *Monetary and Financial Statistics*, December 2003: <http://www.bankofengland.co.uk/statistics/ms/artdec03.pdf>

⁸ See the appendix to the article "A Work Programme in Financial Statistics" in the April 2006 issue of this publication: <http://www.bankofengland.co.uk/statistics/ms/art1apr06.pdf>.