# Seasonal adjustment: 2010 annual review

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*This article reports the results of the latest annual review of the seasonal adjustment of the Bank of England's published monetary statistics series. It outlines the scope of the review, summarises the changes made and explains a methodological change to the way Easter is accommodated for in amounts outstanding, or levels, series.*

## Introduction

Seasonal adjustment aims to identify, estimate and remove regular seasonal fluctuations and typical calendar effects (e.g. trading day) from time series data. Regular seasonal fluctuations are those movements which, on the basis of the past movements of the time series in question, can under normal circumstances be expected to recur with similar intensity in the same season each year.

Since 2005 the Bank has conducted an annual review of the seasonal adjustment settings of all its monetary data series to ensure these remain satisfactory. This article outlines the results of the 2010 review.

## The 2010 annual review

The review prioritised:

- series that appear in the Bank's statistical releases, including series previously assessed as non-seasonal;
- recently created series based on data reported by mutual institutions;
- series on M4 and M4 lending excluding intermediate other financial corporations (OFCs);
- the aggregation structure of Table A5.4 (Monthly lending secured on dwellings: approvals);
- the introduction of a new Easter stock regressor for some series on amounts outstanding (or levels); and
- a selection of other series where initial X-12-ARIMA diagnostic tests indicated that it might be possible to improve on the existing seasonal adjustment.

In January 2010 the Bank outlined the cessation of separate published statistics for banks and building societies in order to avoid possible disclosure of individual institutions' data. This resulted in the introduction of several new series for lending to individuals by mutual institutions[1]. In place of the discontinued separate statistics, statistics for a combined MFI sector are now published in addition to new mutuals time series. A large number of changes in the 2010 review arise from these new series.

A review of the quarterly statistics on M4 and M4 lending excluding intermediate OFCs[2] continued to identify deposits from and loans to intermediate OFCs as non-seasonal. The associated seasonally adjusted monthly statistics will continue to be indirectly obtained, that is, M4 excluding intermediate OFCs is defined as seasonally adjusted M4 *less* non-seasonally adjusted deposits from intermediate OFCs[3].

A review of Table A5.4 (Monthly lending secured on dwellings: approvals) involved assessment of the aggregation structure for seasonal adjustment of these data; that is, determining whether seasonal adjustment of the totals measures in this table should be directly or indirectly obtained. This resulted in two series changing from indirect to direct adjustment:

- *Monthly value of total sterling approvals for secured lending to individuals (VTVQ); and*
- *Monthly value of MFIs sterling approvals for secured lending to individuals (B3HF).*

For the above series, residual series will be published on the Statistical Interactive Database to capture the differences between seasonally adjusted totals and the sums of their components.

Overall, 140 series were reviewed this year and, as in the past, the following issues were considered:

- presence of seasonality;
- ARIMA model;
- calendar effects e.g. trading day;
- outliers; and
- seasonal and trend filters.

Table 1 summarises the main changes following the review. 70 series of the 140 had their settings left unchanged. All changes have been introduced with effect from the current data vintage, as published in this edition of *Monetary and Financial Statistics*.

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[1] 'Changes to the Publication of Bank and Building Societies Statistics', by Pat O'Connor, *Bank of England Monetary & Financial Statistics,* January 2010.
http://www.bankofengland.co.uk/statistics/ms/articles/artjan10.pdf

[2] 'Measures of M4 and M4 lending excluding intermediate other financial corporations', by Norbert Janssen, *Bank of England Monetary & Financial Statistics*, May 2009.
http://www.bankofengland.co.uk/statistics/ms/articles/art1may09.pdf

[3] Indirect adjustment is when, for example, the seasonally adjusted total is obtained as the sum of the seasonally adjusted components; direct adjustment is when a total measure and its components are each independently seasonally adjusted.

**Table 1: Annual review summary**

| Change | Number of series[a] |
|---|---:|
| No changes | 70 |
| Changed from seasonal to non-seasonal | 4 |
| Changed from non-seasonal to seasonal | 0 |
| ARIMA model changed | 33 |
| Outliers changed | 48 |
| Trading day variables added | 4 |
| Trading day variables removed | 4 |
| Easter effect variable added | 5 |
| Easter effect variable removed | 5 |
| Other regressor variable[b] added | 2 |
| Other regressor variable removed | 1 |
| Changes to trend or seasonal filters | 17 |

[a] The sum of the number of series tabulated is greater than 140 as individual series may have multiple changes.

[b] Denotes a Jubilee effect regressor that adjusts for the impact of the move of the late May Bank Holiday and the creation of a one-off additional Bank Holiday in June 2002 to mark the Queen's Golden Jubilee.

*Easter stock regressor*

Easter is a moving holiday that can occur in either March or April (or both) and its effects on time series data, if found significant, should be removed prior to the estimation of the seasonal factors, in the same way that trading day effects are removed.

An improved methodology[4] for dealing with possible end-of-month Easter effects has been implemented for seven series in this publication. Previously, the same method had been used for both stocks and flows series, despite the fact that the Easter regressor was designed originally for flow series. A user-defined UK Easter stock regressor (covering the whole of the UK Easter holiday period) was tested against a US Easter stock regressor (Easter Sunday only). Analysis showed that there were insignificant differences between using a UK-specific regressor and a regressor based on Easter Sunday. Given the small differences and that the latter regressor has been introduced in a prototype X-13ARIMA-SEATS package, the US Easter stock regressor approach has been adopted.

For example, a stock Easter effect is found to be statistically significant, having a positive impact, for the series monthly amounts outstanding of MFI credit card lending to individuals (excluding securitisations). The effect implies that an increase in levels, as a consequence of Easter, has been detected in this case. Chart A shows a comparison between the stock and flow Easter regressors. There is a small but discernible difference between the seasonally adjusted series arising from use of the Easter stock and Easter flow regressors.

**Chart A: Flows of MFI credit card lending to individuals, excl. securitisations**
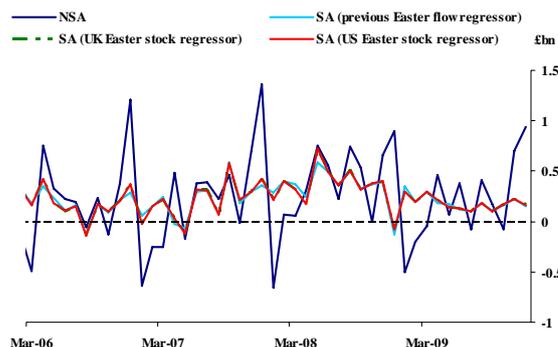


# X-12-ARIMA updates and future reviews

The US Bureau of the Census has recently introduced a Windows interface to X-12-ARIMA which incorporates an updated version of X-12-ARIMA (Version 0.3, Build 188). The Bank has decided not to update to this version but to await the results of applying the forthcoming X-13ARIMA-SEATS package on the monetary data before considering a change.

A prototype version of X-13ARIMA-SEATS was used to corroborate the chosen user-defined Easter stock regressor, as described above.

The Bank will continue routinely to monitor the seasonal adjustment performance of its monetary series and to document significant changes in this publication.

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[4] See 'Stock Series Holiday Regressors Generated by Flow Series Holiday Regressors' by David F. Findley (U.S. Bureau of the Census), April 2009. http://www.census.gov/ts/papers/rrs2009-04.pdf