

Technical note

Annual revision of the models for seasonal adjustment

Every year in August the seasonally adjusted financial time series (*currency in circulation*, the money stock measures *M1* and *M2*, and the *MFI sector's lending to households* and to *non-financial corporations*) are revised. In connection with the revision, the seasonal components are re-estimated for the following 12 months and, if necessary, the models are revised. Since last year's models were generated, new observations have been added to the unadjusted series.

The revision showed that the models still have significant statistical characteristics. The changes in the regression and ARIMA models are small, and the filters used in the actual adjustment are unchanged¹.

There are indications, however, of changing seasonal patterns in *M1* and *M2* as the quarterly pattern is not as distinct anymore². This should be taken into account in next year's revision.

In the series for the *MFI sector's lending to households* and to *non-financial corporations* there are indications of non-stationary behaviour in the first differences. However, after thorough examination of the series, ARIMA models of the first order (I(1) processes) were still chosen because they fit the data better than I(2) processes and had better results in the various specification tests. In next year's revision, the development of these series should therefore be taken into account.

In table 1 is shown the criteria for choosing the regARIMA models and the seasonal filters. Table 2 shows the outliers that were found in the series and the day-of-the-week effect for the *currency in circulation*.

¹ Last year's models are described in Danmarks Nationalbank, Working Paper 44/2006.
² The seasonal pattern is described in "Seasonally Adjusted Financial Statistics", Monetary Review, 3rd.Quarter.

REGARIMA MODEL STATISTICS AND SLIDING SPANS DESCRIPTIVE STATISTICS

Table 1

	Currency in circulation	M1	M2	MFI sector's outstanding lending to households	MFI sector's outstanding lending to non-financial corporations
Model	(0 1 1) ₁₂ (0 1 1)	(0 1 3) ₁₂ (0 1 1)	(0 1 3) ₁₂ (0 1 1)	(0 1 3) ₁₂ (0 1 1)	(0 1 3) ₁₂ (0 1 1)
Number of estimated parameters ...	10	9	7	9	7
Effective number of observations	71	71	71	71	71
RegARIMA-related statistics					
Adjusted loglikelihood	-492.5	-724.3	-755.1	-697.7	-715.1
AIC	1005.1	1466.5	1524.2	1413.4	1444.2
Hannan-Quinn	1014.1	1474.6	1530.5	1421.5	1450.5
BIC	1027.7	1486.9	1540.0	1433.7	1460.1
Residual Normality and autocorrelations					
Kurtosis	2.277	3.984	2.953	2.820	2.229
Autocorrelation based on Q-statistics	No sign of residual autocorrelation (except at lag 3)	No sign of residual autocorrelation	No sign of residual autocorrelation before lag 31	No sign of residual autocorrelation	No sign of residual autocorrelation
Forecasting Performance					
Average absolute percentage error in out-of-sample forecasts (last 3 years)	1.52	3.71	1.40	0.89	2.74
Introductory tests					
F _S -test	55.2 [<i>P</i> <0.1%]	27.6[<i>P</i> <0.1%]	25.7 [<i>P</i> <0.1%]	30.0 [<i>P</i> <0.1%]	12.9 [<i>P</i> <0.1%]
F _M -test	2.1 [<i>P</i> <5%]*	1.3[<i>P</i> >5%]	1.9 [<i>P</i> <5%]*	6.8 [<i>P</i> <1%]*	0.9 [<i>P</i> >5%]
M7	0.349	0.443	0.498	0.676	0.610
Evaluating tests					
F _S -test (residual seasonality)	0.22 [<i>P</i> >10%]	0.88 [<i>P</i> >10%]	0.41 [<i>P</i> >10%]	0.05 [<i>P</i> >10%]	0.12 [<i>P</i> >10%]
M8	0.537	0.847	0.987	0.844	1.056*
M9	0.387	0.682	0.714	0.742	0.600
M10	0.649	0.926	1.133*	0.920	1.076*
M11	0.623	0.851	1.049*	0.905	0.972
Sliding Spans					
S(%)	0% (0/114)	2.6% (3/114)	4.4% (5/114)	0% (0/114)	0 % (0/114)
MM(%)	0% (0/113)	13.3% (15/113)	13.3% (15/113)	0% (0/113)	2.7% (3/113)
YY(%)	0% (0/102)	0% (0/102)	0% (0/102)	0% (0/102)	0 % (0/102)

Note: P-values in brackets. * means that the test has failed.

PREADJUSTMENT OF THE DANISH DATA

Table 2

	Currency in circulation	M1	M2	MFI sector's outstanding lending to households	MFI sector's outstanding lending to non-financial corporations
Day-of-the-week effect	Monday [1.71] Tuesday [-5.67] Wednesday [-4.14] Thursday [-0.71] <i>Jointly significant</i>				
Additive outliers (AO)	2001:8 [4.34] 2003:3 [-3.82] 2003:12 [4.25]	2002:6 [-4.36] 2002:9 [5.52] 2006.1 [19.57]	2006:1 [9.99]	2000:8 [-3.86] 2001:12 [4.42] 2002:8 [4.69]	2003:12 [4.18] 2004:4 [2.75]
Level shifts (LS)	2004:6 [-7.04] 2005:6 [6.16] 2005:8 [4.88]				

Note: In the table, the preadjustment of the five investigated time series are presented by their location and corresponding *t*-values (in brackets).