INTRODUCTION

As from the autumn of 2006 Danmarks Nationalbank will publish seasonally adjusted financial statistics for currency in circulation, lending to households and to non-financial corporations, and for the monetary aggregates M1 and M2 for the period from January 1995.

Seasonally adjusted financial data can be used to obtain a more accurate assessment of short-term cyclical developments in the Danish economy, and for analysis of long-term structural trends.

Seasonal fluctuations in data entail that there is systematic variation in the statistics, which masks the underlying trend. For example, currency in circulation rises considerably in December each year due to the Christmas trade, and households tend to hold more banknotes and coins just before the summer holiday period and when tax refunds are paid out. The figures can be adjusted for these recurring, predictable seasonal effects so as to facilitate identification of both trends and cyclical fluctuations. Furthermore, seasonal adjustment makes it possible to monitor changes in seasonality over time. While seasonal fluctuations in real-economic data are often attributable to weather conditions, harvest, national holidays, etc., seasonal fluctuations in financial data are more attributable to institutional factors such as payment schedules and compilation methods. For example, the restructuring of financial statistics in accordance with the EU's statistical definitions for MFIs\(^1\) has affected the seasonality in the series. For each series separate models have thus been devised for each sub-period before and after the restructuring\(^2\).

In an international perspective, seasonally adjusted financial time series are already provided and demanded in a number of countries, while Denmark has so far primarily published seasonally adjusted real-

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\(^1\) MFIs are Monetary Financial Institutions, comprising Danmarks Nationalbank, banks and mortgage-credit institutes, etc.

\(^2\) For each series seasonal adjustment has been made separately for the sub-periods from January 1995 to end-June 2000 and as from July 2000 after the introduction of the MFI statistics.
economic data concerning e.g. retail sales, car sales and the gross domestic product. The methodology is essentially the same, but only now are the available financial time series sufficiently long to provide a sound basis for seasonal adjustment. These more technical aspects in relation to methodology and revision policy are described in detail in a separate Working Paper from Danmarks Nationalbank, which is expected to be published simultaneously with the first seasonally adjusted data.

This article gives a number of examples of and offers explanations for seasonal fluctuations in currency in circulation, monetary aggregates (M1 and M2), and lending by banks and mortgage-credit institutes to households and non-financial corporations, and for how seasonally adjusted lending statistics can facilitate analysis on a month-on-month basis. All data in this article is included in Danmarks Nationalbank's balance-sheet and flow statistics for the MFI sector that are published monthly.

**SEASONALITY IN CURRENCY IN CIRCULATION**

Currency in circulation is a compilation of the value of banknotes and coins in circulation in Denmark at month-end. The unadjusted series shows strong month-on-month fluctuation. Some of this fluctuation reflects "weekday patterns", i.e. currency in circulation is generally highest on Fridays and lowest on Tuesdays and Wednesdays. This reflects that demand for cash increases just before the weekend when the banks are closed and people are not at work and have time to spend money. It is useful to adjust for this weekday effect before determining the seasonal pattern over the 12 months of the year.

Chart 1 shows the seasonal components of currency in circulation. The component for a given month illustrates that month's deviation from the underlying level.

The seasonal component for December is the largest, at 1.5-2 per cent of the level of currency in circulation. Actual currency in circulation is reduced by this percentage to achieve the seasonally adjusted currency in circulation in December. The demand for cash is increased by e.g. the large number of transactions in connection with the Christmas trade. The figure for November is also adjusted for a generally high level of currency in circulation. The development over time in the seasonal

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1. Reference is made to Statistics Denmark as regards real-economic data.
2. In principle, the seasonally adjusted time series will be revised on an annual basis.
3. Seasonal adjustment is made using X-12-ARIMA, an internationally recognised program.
4. I.e. season in the sense that the balance is influenced by the day of the week on which it is compiled. Currency in circulation (as well as all other series treated in this article) is compiled in the balance-sheet and flow statistics for the MFI sector on the last banking day of the month. Banking days are the days on which the banks are open to customers, i.e. from Monday to Friday in Denmark.
components for November and December shows a tendency for increasing adjustment in November and declining adjustment in December. This may indicate that the Christmas trade is gradually being spread more over November and December.
A relatively high level of currency in circulation is also observed in the spring and summer months of April, May, June and July. This may reflect disbursement of tax refunds and holiday pay, and increased demand for liquidity in the summer holiday period.

Chart 2 shows unadjusted and seasonally adjusted currency in circulation. The seasonally adjusted series takes a considerably smoother course and also appears to reflect the underlying trend more accurately.

SEASONALITY IN MONETARY AGGREGATES (M1 AND M2)

The monetary aggregate M1 consists of currency in circulation and overnight deposits (excluding deposits from the central government and MFIs). Overnight deposits account for more than 90 per cent of M1, dominating the development in and thereby the adjustment of M1. As a result, M1 does not mirror the seasonal pattern of currency in circulation, cf. Chart 3. The components of M1 are as follows (end-April 2006):

- Overnight deposits from households, 57 per cent
- Overnight deposits from non-financial corporations, 23 per cent
- Overnight deposits from other sectors, 13 per cent
- Currency in circulation, 7 per cent

It should be noted that the method of seasonal adjustment of M1, M2 and the lending series is direct adjustment. The seasonal components of M1 show a quarterly pattern with a low level towards the end of the quarter.

The appearance of the seasonal components of M1 can be explained by the characteristics of the components.

The seasonal pattern of overnight deposits from households shows a low level of deposits in the last month of each quarter and a rising level in the first and second months since these deposits are strongly influenced by the households' quarterly mortgage payments. The seasonal pattern of overnight deposits from non-financial corporations, on the other hand, shows a considerably higher level in January, July, October and December than in the other months. A possible explanation of July's level is that there is no VAT settlement in this month due

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1 Danmarks Nationalbank also produces and publishes statistics for M3 in accordance with ECB guidelines (ECB/2001/13). However, due to technicalities concerning refinancing of Danish adjustable-rate loans, it is difficult to interpret the M3 series in economic terms, so M3 is not subject to seasonal adjustment.

2 Direct adjustment means immediate adjustment of the series, whereas indirect adjustment implies individual adjustment of the components, which are then aggregated.

3 The seasonal pattern changes if the proportion of households with monthly mortgage payments rises.
to the summer holiday period. On the other hand, VAT settlement for August covers a 2-month period. The money is often placed in a current account in the meantime, resulting in larger balances at the end of July. Similarly, the high seasonal component for October is attributable to a relatively high level of overnight deposits from non-financial corporations in this month. These deposits are used in November for payment of the non-financial corporations’ tax on account and for payment of residual tax for the preceding fiscal year. The high level of overnight deposits from non-financial corporations in December and January is probably attributable to revenue from the Christmas trade. In summary, the seasonal components of M1 reflect a number of different factors.

M2 consists of M1, deposits with an agreed maturity of up to and including 2 years and deposits redeemable at notice of up to and including 3 months (excluding deposits from the central government and MFIs). The components of M2 at end-April 2006 are as follows:

- M1, 81 per cent
- Deposits with an agreed maturity of up to 2 years, 17 per cent
- Deposits redeemable at notice of up to and including 3 months, 2 pct.

M1 accounts for by far the largest share of M2, and the seasonal components generally follow the same pattern as described for M1. Since deposits with an agreed maturity of up to 2 years show the same sea-

Note: The Chart shows the seasonal components for the model for the period as from July 2000. For a given month, the Chart shows the size and development over time of the seasonal component. The seasonal component reflects the month’s typical deviation from the underlying level. A seasonal component greater than 1 means that the series is normally at a high level for this month compared to the underlying level.
sonal pattern as overnight deposits, the seasonal pattern of M2 appears to be an amplified M1 pattern, although M2 is less liquid than M1.

SEASONALITY IN LENDING TO HOUSEHOLDS AND NON-FINANCIAL CORPORATIONS

An analysis of the development in lending is for instance of relevance in connection with cyclical analysis or analysis of financial stability. This section focuses on lending to households.

Lending to households is seasonal, with a relatively high level of lending in the last month of each quarter, cf. Chart 4.

Quarterly mortgage payments are once again a possible explanation for the seasonal pattern since besides the effect on deposits they also have a significant effect on lending to households.

However, in percentage terms the seasonal components in Chart 4 are clearly lower than for M1, and it can be difficult to distinguish the seasonally adjusted series for lending to households from the unadjusted series. A comparison of deviations from the trend for unadjusted and seasonally adjusted lending to households clearly shows that seasonal adjustment reduces the volatility of the lending series, cf. Chart 5.

The seasonally adjusted series also shows considerable deviation from the trend in certain months. These deviations can be explained by vari-

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SEASONAL COMPONENTS OF LENDING TO HOUSEHOLDS

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Note: A value greater than 1 indicates that lending is higher than the underlying level, whereas a value less than 1 means that lending is lower than the underlying level. The seasonal components are for the model for the period as from July 2000.
ous economic events. The deviations in August of 1996, 1999, 2002 and 2005 reflect that the mortgage-credit institutes change bond series in August of every third year. This entails that the mortgage-credit institutes begin to issue bonds in a new series, so that some households move new borrowing forward or convert their existing loans in the period up to the opening of the new series in order to benefit from the higher bond prices in the old series due to a shorter time to maturity. This three-year regularity disturbs the seasonal components, so temporary adjustment is made beforehand ¹.

Seasonally adjusted data is also compiled for lending to non-financial corporations. However, the seasonal pattern of lending to non-financial corporations is less stable than the pattern for households, particularly in the spring months. The less stable seasonal pattern can be attributed to changed deadlines for payment of direct and indirect taxes. In addition, shifts in the dividend disbursement pattern may affect non-financial corporations' borrowing requirement.

CONCLUSION

Danmarks Nationalbank’s published time series for currency in circulation, lending to households and the monetary aggregates M1 and M2

¹ This will be discussed in the Danmarks Nationalbank Working Paper mentioned above.
follow a clear seasonal pattern. Danmarks Nationalbank will begin to publish seasonally adjusted data in order to facilitate analysis of the development month-on-month. This article gives a number of examples and offers explanations for the seasonal patterns. More time series may be subject to seasonal adjustment at a later stage to the extent that significant seasonality is found in the models for other financial time series published by Danmarks Nationalbank. However, this will require data to be available for a sufficiently long period of time.