Constrained Seasonal Adjustment for Correlated Series: How the Fed Seasonally Adjusts Liquid Deposits

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The analysis and conclusions set forth are those of the authors and do not indicate concurrence by other members of the research staff or the Board of Governors.
Agenda

• Background
• Define the problem
• Explain our solution
• Effectiveness of the solution
Background

• The money supply is the total amount of money—cash, coins, and balances in bank accounts—in circulation.

• Two standard measures of the money supply include:
  – M1: the sum of currency held by the public and transaction deposits (i.e. “checking accounts”) at banks
  – M2: M1 plus savings deposits, small time deposits, and retail money market mutual fund shares.

• Not seasonally adjusted (NSA) and seasonally adjusted (SA) measures of M1 and M2 are provided to the public as weekly and monthly averages on the H.6 Statistical Release.
### H.6. Statistical Release

#### Table 1: Money Stock Measures

<table>
<thead>
<tr>
<th>Date</th>
<th>Seasonally adjusted</th>
<th>Not seasonally adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M1(^1)</td>
<td>M2(^2)</td>
</tr>
<tr>
<td>2017-Oct.</td>
<td>3,506.7</td>
<td>13,779.0</td>
</tr>
<tr>
<td>Nov.</td>
<td>3,830.6</td>
<td>13,809.5</td>
</tr>
<tr>
<td>Dec.</td>
<td>3,612.0</td>
<td>13,852.0</td>
</tr>
<tr>
<td>2018-Jan.</td>
<td>3,653.1</td>
<td>13,868.1</td>
</tr>
<tr>
<td>Feb.</td>
<td>3,622.5</td>
<td>13,890.6</td>
</tr>
<tr>
<td>Mar.</td>
<td>3,656.3</td>
<td>13,941.3</td>
</tr>
<tr>
<td>Apr.</td>
<td>3,660.2</td>
<td>13,976.5</td>
</tr>
<tr>
<td>May</td>
<td>3,654.6</td>
<td>14,038.3</td>
</tr>
<tr>
<td>June</td>
<td>3,655.1</td>
<td>14,107.8</td>
</tr>
<tr>
<td>July</td>
<td>3,676.9</td>
<td>14,148.8</td>
</tr>
<tr>
<td>Aug.</td>
<td>3,679.9</td>
<td>14,190.8</td>
</tr>
<tr>
<td>Sept.</td>
<td>3,703.7</td>
<td>14,225.3</td>
</tr>
<tr>
<td>Oct.</td>
<td>3,720.8</td>
<td>14,246.6</td>
</tr>
<tr>
<td>Nov.</td>
<td>3,700.1</td>
<td>14,264.7</td>
</tr>
<tr>
<td>Dec.</td>
<td>3,751.3</td>
<td>14,368.0</td>
</tr>
</tbody>
</table>

• Seasonal factors for weekly and monthly data series are generated once a year.
  – Monthly seasonal factors are created using X-13ARIMA-SEATS.
  – Weekly seasonal factors are derived using in-house time-varying least squares method.
• Staff have developed a methodology for ensuring weekly and monthly seasonal factors are consistent.
The Problem

- In 1994, the Federal Reserve began allowing banks to transfer customer deposits from checking accounts to savings accounts to reduce reserve requirements.
- The use of these so-called “retail sweeps” spread slowly initially.
- Starting in the second quarter of 1995, retail sweeps took off.
The Problem (Cont’d)

• As sweeping grew in size and number, they destabilized normal seasonal patterns related to checking account payment flows, and created new, negatively correlated seasonal patterns in the recipient savings deposit series.

Weekly Changes in Balances of Checking and Saving Accounts

Source: H.6 Statistical Release (available on the Board of Governors’ website)
Note: Checking accounts represent the sum of Demand Deposits Adjusted and Other Checkable Deposits at all institutions on the H.6.
The Problem (Cont’d)

- The sum of data on checking and savings accounts, which we define as “liquid deposits,” retained much more stable weekly patterns.

Weekly Changes in Liquid Deposits: Pre & Post Sweeps

Source: H.6. Statistical Release (available on the Board of Governors’ website)
The Problem (Cont’d)

• Seasonally adjusting liquid deposits yields more stable and reliable seasonable factors than seasonally adjusting each of its components.

• However, individual SA levels of the components are needed to support the construction of the monetary aggregates.

• Resulting problem:
  \[ \text{Liquid Deposits}_{SA} \neq \text{Checking}_{SA} + \text{Savings}_{SA} \]
Our Solution

• We’ve developed a method to constrain SA levels of Checking and Savings, individually, so that their sum is equal to the SA level of Liquid Deposits.

• The constraining process is run in 4 steps.
Our Solution (Cont’d)

• Step 1: Generate SA levels for Liquid Deposits, Checking, and Savings for period t.

• Step 2: Build the SA constraint, or \( r_{SA,t} \), as

\[
\frac{\text{Liquid Deposits}_{SA,t}}{\text{Checking}_{SA} + \text{Savings}_{SA,t}}
\]

using SA levels from step 1.

• Step 3: Derive the constrained SA level by multiplying \( r_{SA,t} \) (step 2) by SA levels for Checking and Savings (step 3) individually.

– E.g. \( \text{Constrained Checking}_{SA,t} = r_{SA,t} \times \text{Checking}_{SA,t} \)
Our Solution (Cont’d)

• Step 4: Derive the constrained seasonal factor for each component as the ratio of the historical NSA level to the constrained SA level (from step 3) for each component.

  – E.g. \( \text{Checking}_{SF,t} = \frac{\text{Checking}_{NSA,t}}{\text{Constrained Checking}_{SA,t}} \)
Effectiveness of the solution

• Technique improves overall smoothing of seasonal adjustment process.

<table>
<thead>
<tr>
<th>Standard Deviations of Changes in Logs</th>
<th>Original</th>
<th>Corrected</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checking Deposits</td>
<td>0.01726</td>
<td>0.01684</td>
<td>2.4%</td>
</tr>
<tr>
<td>Savings Deposits</td>
<td>0.00426</td>
<td>0.00416</td>
<td>2.5%</td>
</tr>
<tr>
<td>Liquid Deposits</td>
<td>0.00334</td>
<td>0.00281</td>
<td>16.0%</td>
</tr>
</tbody>
</table>

• Improved smoothing extremely important for interpreting emergent trends in data.
Effectiveness of the solution (Cont'd)

Changes in Logged Levels of Liquid Deposits

-0.02 -0.01 0 0.01 0.02 0.03 0.04

Effectiveness of the solution (Cont’d)

Changes in Logged Levels of Liquid Deposits

Liquid Deposits Uncorrected

Liquid Deposits Corrected
Effectiveness of the solution (Cont’d)

Changes in Logged Levels of Checking Deposits
Questions
References


• Retail Sweeps, https://research.stlouisfed.org/aggreg/swdata.html