2. Seasonal Adjustment of Monetary Aggregates in Taiwan

Introduction

Monetary aggregates have been important information variables for the Bank's monetary policy-making. The Bank has regularly published data on monetary aggregates in its *Financial Statistics Monthly*. However, monetary aggregates time series in Taiwan exhibit several seasonal movements that recur during public holidays, tax payment days, the start of a new school year, and the calendar year-ends. It is therefore important to capture the nature and the effects of the seasonal factors when analyzing monetary aggregates. In 2006, the Bank has completed a study on seasonal adjustment of monetary aggregates in Taiwan. This annex briefly introduces the seasonal adjustment method and procedures for monetary aggregates in Taiwan.

X-12-ARIMA Adjustment Method Adopted by Major Countries

To seasonally adjust time series data on monetary aggregates, central banks in major countries such as the Federal Reserve, the Bank of England, the European Central Bank, and the Bank of Japan, generally adopt the X-12-ARIMA adjustment method developed by the US Census Bureau. The popularity of the X-12 ARIMA program was due to its stronger filter function as well as many new diagnostics. Seasonally adjusted monetary aggregates data are usually produced in the form of percentage changes and are disseminated in monetary authorities' official publications and websites. However, methods used to calculate percentage changes are different among countries[1]. In addition, to minimize variations in the seasonally adjusted data series, the time period for the identification of seasonal adjustment models in most central banks are not changed for one year.

Studies on the Moving-Holiday Effect of the Chinese New Year

The Chinese New Year, the most important holiday in Taiwan, is based on a lunar calendar. It is a moving holiday on the Gregorian calendar. The effect of the shifting Chinese New Year on monetary aggregates data has been studies for long. The earliest study regarding this

1 For instance, the Federal Reserve and the Bank of England use quarterly and 6-month percentage changes to calculate annualized percentage changes, while monthly and annual percentage changes are not annualized. The European Central Bank transforms the seasonal adjusted data into an index series and calculates the year-on-year growth rate. As for the Bank of Japan, all the percentage changes of the seasonally adjusted data are annualized.

subject could trace back to Perng (1982)[2], using US Census Bureau's X-11 program to seasonally adjust the end-of-period data for M1, currency held by the public, and deposit money, after adjusting for the shifting Chinese New Year.

Lin and Liu (2003)[3] used regARIMA model in the X-12-ARIMA program for the first time to deal with the moving holiday effect arising from the shifting Chinese New Year in Taiwan. They constructed three explanatory variables-- before, during, and after the Chinese New Year, and applied the AICC (F-corrected AIC) method to test if these variables can improve the explanatory power of the model. Due to the lack of daily data, the distributions of these three variables were assumed to be rectangular distribution. The authors tested on M1A, M1B, and M2 and found that the duration of the influences were fifteen days before and after, and six days during the Chinese New Year holidays. This result was very close to Perng (1982)'s findings.

The Procedures Used by the Bank for Seasonal Adjustment

The Bank's research team adopts X-12-ARIMA method for seasonal adjustment. However, with a shifting Chinese New Year holiday, the holiday effect adjustment procedure developed for fixed holidays cannot be applied to the Bank's model. To improve the accuracy of seasonal decomposition, the Bank follows Perng (1982) and Lin and Liu (2003), using daily data to transform the rectangular distribution with a constant daily effect into bell-shape distribution with a variable daily effect. In other words, the research team uses daily data to construct three monthly factors to capture effects before, during, and after the Chinese New Year and applies the regARIMA model to deal with the effect of the shifting Chinese New Year, and produce the seasonally adjusted monetary aggregates.

To facilitate greater use of the financial statistics data as well as to improve transparency, the Bank starts to publish the seasonally adjusted data on the "Seasonally Adjusted Key Financial Indicators Table" in the appendix to the *Financial Statistics Monthly* in 2007. The table presents the seasonally adjusted statistics for currency held by the public, reserve money, M1A, M1B, M2, deposits, and bank credit. All series are traced back to January 1992. The data will also be available on the Bank's website.

To avoid the confusion caused by model changing and recalculation, past seasonal factors remain fixed, which is the same treatment used by major central banks. The Bank follows this

2 Perng, Fai-nan, 1982, "Seasonal Adjustment of Monetary Aggregates and the Effect of Shifting Chinese New Year on Currency and Deposit Money," *Quarterly Bulletin of the Central Bank of the Republic of China (Taiwan)*, Vol. 4, No.1, March 1982. (only in Chinese version)

3 Lin, Jin-Lung and Tian-Syh Liu, 2003, "Modeling Lunar Calendar Holiday Effects in Taiwan," *Taiwan Economic Forecast and Policy*, Vol 33, No 2, Institute of Economics, Academia Sinica, Taiwan.

approach and revises the seasonally adjusted series in each June and December to ensure a better quality of seasonal adjustment.