Decumulating China's Quarterly National Accounts

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Introduction

The NBS has been publishing quarterly national accounts, compiled broadly in line with the SNA, since 1992. However, like many quarterly statistics published by NBS they are "cumulated" in the course of each year and cover January – March, January – June, January –September and January-December.

Cumulative reporting for both monthly and quarterly statistics was common in countries that practised central planning. These countries – China, the former Soviet Union, Vietnam, and Cuba among others - worked with five year plans that specified output targets for a detailed list of products. The targets in the five year plans were broken down into annual targets and it was these annual targets that gave rise to the system of cumulative data reporting. Officials in local and central government who were held accountable for achieving the annual targets, needed statistics that would show the progress towards meeting them.

Note that this is in sharp contrast to the situation in market economies. In these countries, policy-makers want statistics that show the **underlying trends** of GDP, consumer spending, unemployment, industrial output, prices, etc. They want to know what has happened in the last month or quarter and what this implies for the trend in the immediate future. This trend is revealed by the process of seasonal adjustment and most economic statistics published in OECD countries are shown in both "raw" and seasonally-adjusted form.

As China is moving towards a "social market economy" it might be expected that policy-makers would start to move in the same direction as their counterparts in market economies. When China joined the IMF's General Data Dissemination System (GDDS) in April 2002, the IMF team recommended that the quarterly national accounts be changed to record value added and expenditures in discreet quarters. This has also been urged on the Chinese authorities by the OECD which has been publishing China's quarterly national accounts and related statistics for some years. But these suggestions have fallen on deaf ears. This is no doubt due partly to the caution of local and central government officials who are accustomed to using cumulated data and see no good reason to change in order to satisfy users outside China. More important perhaps, the reporting systems in place for many of the key statistics needed for the quarterly accounts are based on cumulative reporting. Switching to reporting for discreet quarters would mean retraining the statistical staff and redesigning the reporting forms. These are not simple tasks given the size and bureaucratic complexity of China.

Seasonal adjustment

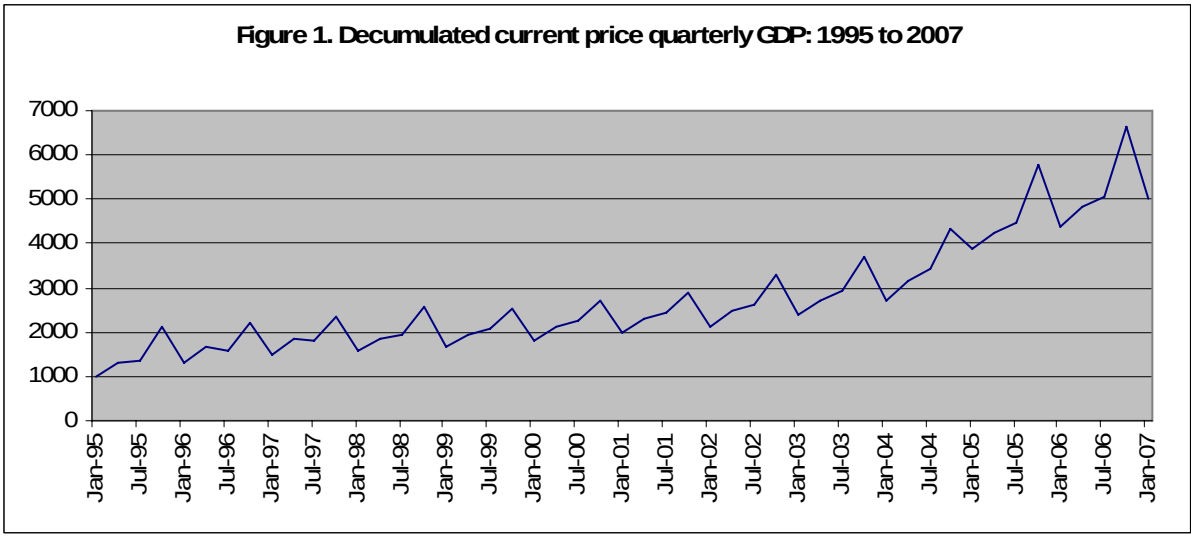
For users of Chinese statistics outside China, the answer may seem simple. The cumulated quarterly accounts can be decumulated by differencing successive cumulated quarters. NBS staff warn against this, however, because the data reporters make revisions to their cumulated reports without assigning them to a specific quarter. For example, the value added reported for the period January to September may include corrections to either of the two earlier quarters. While this is a valid point when considering the simple, or "raw" decumulated accounts, it is less valid if those raw data are seasonally adjusted.

The revisions made to successive cumulated quarterly accounts are of two kinds. Some may be "seasonal" because, for example, statistical reporters put all the corrections detected for previous quarters into the figures for January to December; or perhaps all errors detected in the previous year are assigned to the first quarter of the following year. If the corrections are **systematic** in the sense that they are made to cumulated quarters in a regular fashion, they will be detected as a seasonal

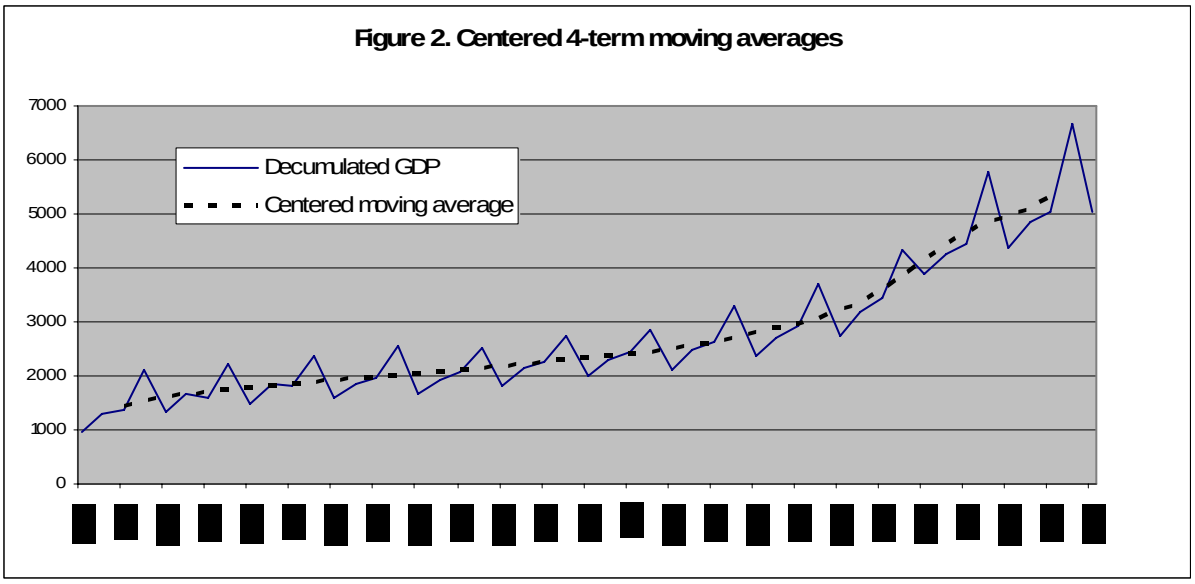
disturbance and will be eliminated in the process of seasonal adjustment. Systematic, regular corrections, therefore, will not affect the underlying trend that seasonal adjustment is designed to detect.

On the other hand it may be that the corrections are not made in a systematic way. If data reporters make corrections to the cumulative quarterly report as soon as they are detected and if error detection occurs haphazardly throughout the year, the underlying trend shown by the seasonal adjustment process will have a larger error term than would otherwise be the case. It will still, however, remain the best estimate of that underlying trend.

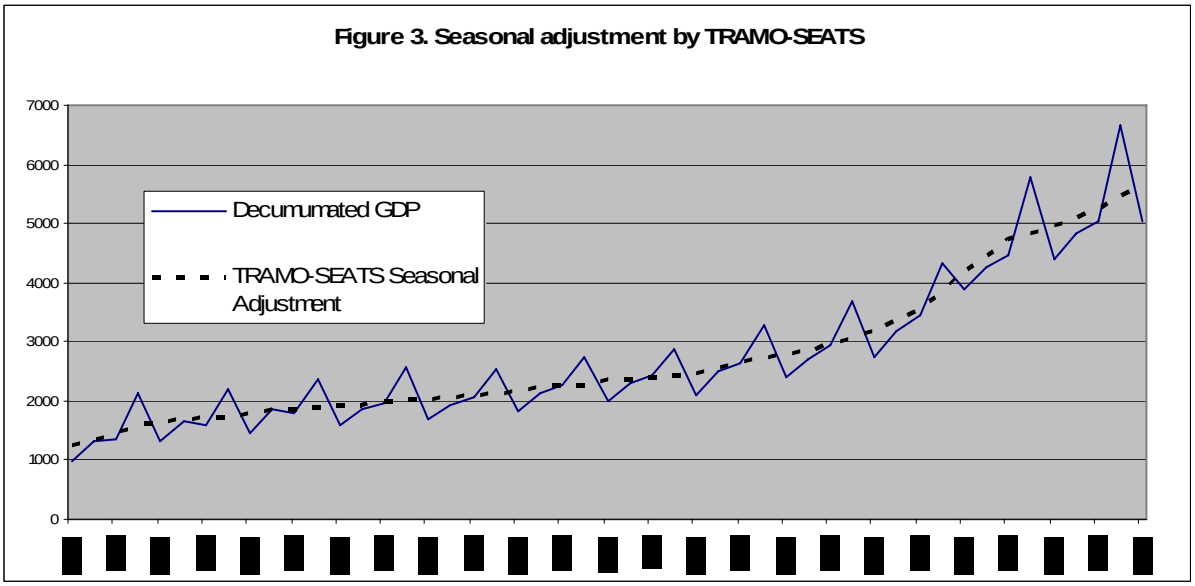
Figure 1 shows decumulated quarterly current price GDP for China from the first quarter of 1995 to the first quarter 2007. Even to the untrained eye, it is obvious that there is a clear seasonal pattern. GDP peaks in the fourth quarter followed by a sharp fall in the first quarter. In the early part of the period the two middle quarters were usually at the same level but, later on, GDP in the third quarter is usually a little higher than in the second.



The simplest way to seasonally adjust a time series is to use moving averages. As the seasonal cycle covers four quarters the obvious method is to calculate moving averages over four quarters. The problem with this however is that four term moving averages are "centred" between the second and third terms. The moving averages shown in Figure 2 have been centred on specific quarters by averaging successive four-term moving average. The effect of this is that the averages shown for each quarter use observations for five quarters, with the first and fifth quarter having half the weight of the three middle quarters.



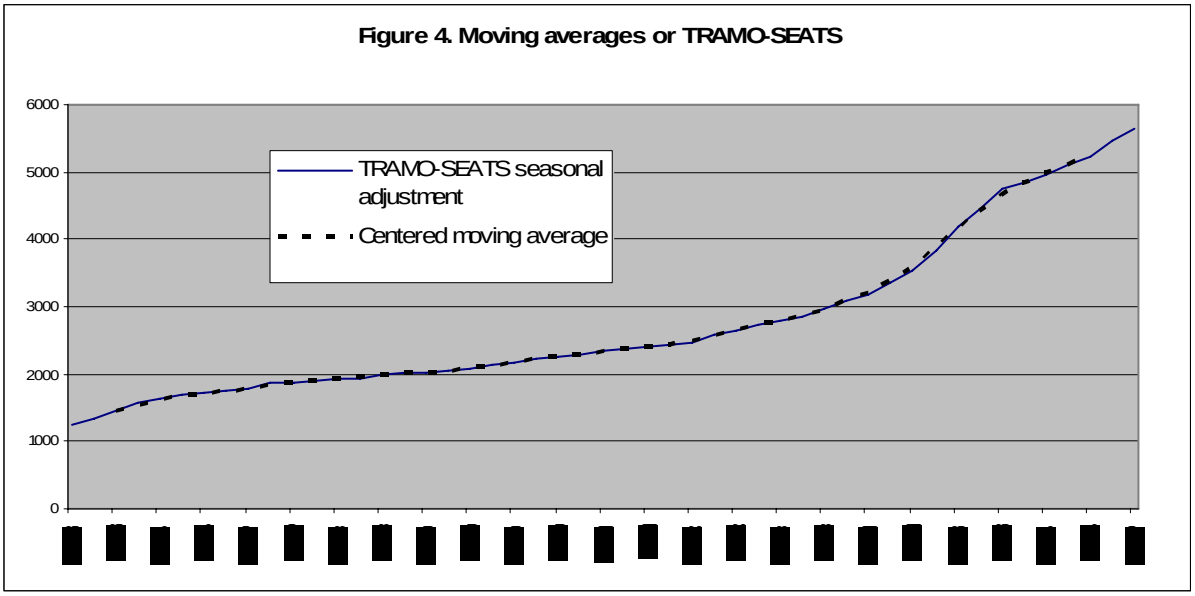
Although the centred 4-term averages provide a good fit to the raw decumulated data, there is an obvious problem with this method of seasonal adjustment : the first two and, more important, the last two quarters are missing. It is precisely the two latest quarters that most interest policy-makers. There are several seasonal adjustment methods that overcome the problem of missing estimates at the beginning and end of a time series. The two best known are the X-12 Arima method developed by the United States Bureau of Labor Statistics, and the TRAMO-SEATS method developed by the Central Bank of Spain and which is widely used by Eurostat for seasonally adjusting monthly and quarterly data for Member states of the European Union. Both of these methods use an ARIMA (Auto-Regressive Integrated Moving Average) method for forecasting the trend of the most recent quarters. X-12 Arima and TRAMO-SEATS give virtually identical results for China's quarterly GDP because it is a well-behaved time series with a very regular, and therefore predictable, seasonality. Figure 3 shows the trend calculated by the TRAMO-SEATS seasonal adjustment programme.



TRAMO-SEATS and X 12 Arima programmes do three things:

- They examine the series for outliers. These may be caused by special events such as strikes, unusual weather conditions, or natural catastrophies. Important work holidays such as Easter, Ramadan and Tet, which are not determined by the Gregorian calendar, may also produce outliers if they fall in different months or quarters. (This does not seem to be a problem for China's quarterly accounts, however, as Tet always occurs in the first quarter.)
- Having removed the outliers, the programmes then calculate a seasonally adjusted trend and add back the outlier observations.
- Finally, they make forecasts for the beginning and end of the series using an ARIMA model.

Figure 4 compares the "naïve" four term moving average with the TRAMO-SEATS trend. They are virtually indistinguishable. What this suggests is that the decumulated Chinese GDP figures have such a regular and predictable seasonal pattern that the sophisticated features of TRAMO-SEATS which are designed to correct for irregularities in the raw series are not required. China's decumulated GDP estimates are an ideal candidate for seasonal adjustment. This does not of course mean that simple moving averages should be used to seasonally adjust the decumulated figures. Either TRAMO-SEATS or W-12 Arima are better as they provide warning signals if the seasonal pattern is disrupted or begins to change and they provide options to correct for this. They also provide forecasts for the latest periods.



Conclusion

On the occasion of China's entry into the IMF's GDDS in 2002, Governor Dai of the People's Bank of China quoted a Chinese poem, which says, "if you want to see far away, you must move up one storey in the pagoda." Here is a chance for NBS to move up a storey at little cost and with great benefit to users of their statistics outside China. Modern seasonal adjustment techniques are already used within the NBS for a variety of analytic purposes and could now be applied to the quarterly national accounts. And this can be done while preserving the cumulative presentation that is preferred by many of their users within China.

The simple analysis above has dealt only with one national accounts series – current price GDP. Before deciding to publish seasonally adjusted decumulated data, NBS would need to

examine the seasonal behaviour of the output and expenditure components of current price GDP as well as that of the constant price data. The initial signs however look promising.

Notes and references

1. The thoughts in this paper build on a paper written by AHN Kil-Hyo when he was working at the OECD. Dr Ahn's paper is included in Series 5 of "Research of Methodological Issues in National Accounts – China" http://www.oecd.org/document/57/0,3343,en_2825_497146_31640185_1_1_1_1,00.html.

2. "Quarterly GDP Estimation in CHINA", by DONG Lihua, Department of National Accounts, NBS gives detailed description of the sources and methods currently used by NBS for the quarterly national accounts. It is included in Series 9 of "Research of Methodological Issues in National Accounts – China".

3. TRAMO stands for "**T**ime series **R**egression with **A**RIMA noise, **M**issing values and **O**utliers", and SEATS for , "**S**ignal **E**xtraction in **A**RIMA **T**ime Series", (Gómez and Maravall, 1996, Banco de España.) This and related software can be downloaded at http://www.bde.es/servicio/software/econome.htm

4. The Eurostat software "DEMETRA" (Raoul Depoutot, Jens Dossé, Servais Hoffmann and Christophe Planas) includes both X-12 ARIMA and TRAMO-SEATS. It is described at http://europa.eu.int/en/comm/eurostat/research/conferences/ntts-98/papers/cp/021c.pdf

5. The United States Bureau of the Census has made an empirical evaluation of the performance of TRAMO/SEATS on simulated series (Catherine C. Hood, James D. Ashley, and David F. Findley, US Census Bureau, ESMPD, Washington, DC 20233) The authors concluded that "SEATS and X-12-ARIMA both perform similarly for the simulated series using 12 years of data. SEATS does a better job with series that have a large irregular component. For the series with only four years of data, X-12-ARIMA does a better job with the series that have a large irregular component. We would like to recommend using SEATS
adjustments for production work at the Census Bureau, in particular for some of our series with large irregular [components]." See http://www.census.gov/ts/papers/asa00_ts.pdf