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An empirical investigation on the temporal properties of China's GDP

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ABSTRACT

This paper employs a structural time series model designed with three components of stochastic seasonality, trigonometric expression of cyclicality and local linear trend to investigate the evolutionary process of China's GDP. In particular, the model is able to detect the stop–go feature of China's economic growth, i.e., growth cycle, as well as business cycle. The empirical result suggests that most variation in China's macroeconomic performance came from business cycle. The investigation of the three components along with historical events suggests that the Chinese economy had been largely influenced by political activities up to the early 1990s. In the mid-1990s China entered a period of stable and highly growing economy, thanks to the economic reform and the successful implementation of macroeconomic policies. However, since the mid-2000s China has become more sensitive to the turbulences in international markets. In the foreseeable future, the challenge facing China is a more volatile economy with possible slowdown in the economic growth, although the growth rate would still be high compared to developed economies.

1. Introduction

Since shifting from a centrally planned to a market based economy with reforms begun in 1978, China has achieved remarkable economic growth. The World Bank (2005) reports that China's GDP grew at an average rate of 10.3% per year in the 1980s, and after 1990 it grew on average at the rate of 9.6% per year. According to Maddison (2007), the time taken for doubling GDP per capita was 58 years in England from 1780 to 1838, 47 years in the United States from 1839 to 1886, 34 years in Japan from 1885 to 1919, and 11 years in Korea from 1966 to 1977. By contrast, the GDP per capita in China doubled within only 9 years from 1978 to 1987, and doubled again in another 9 years from 1987 to 1996. Within three decades, the GDP per capita in China has spectacularly increased 10-folds, which was unparalleled in the history of economic development.

A number of studies have analysed the sources underlying China's economic growth. As summarised by Heytens and Zebregs (2003), the studies have converged on a number of findings. First, the contribution of the state sector to GDP growth dropped from 80% in 1978 to less than 20% in the late 1990s, while the contribution of private and other sectors to GDP growth increased from zero in the early 1980s to nearly two-thirds in the late 1990s. Second, total factor productivity contributed significantly to the GDP growth in China since the economic reform at the end of the 1970s. They also find that the contribution of physical capital accumulation has been large, while the contribution of labour employment growth has been modest. Third, the bulk of economic

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growth since the early 1990s has come from the explosive growth of industrial production, and the ratio of industrial productivity to agricultural productivity has increased spectacularly from 5 times in 1993 to 9 times in 2003. Such findings are a mere reflection of the Chinese government's plans for economic development. Historically, the Chinese government has subsidized and favoured industry and investment over the service sector and domestic consumption. As a result of the growing investment to GDP ratio and the slowing employment growth, the capital–labour ratio has increased substantially and over 90% of the growth in industry after the 1990s was in the form of labour productivity growth rather than employment growth (Bosworth & Collins, 2008).

To trace the volatility characteristic of macroeconomic performance, the transitional economic and political structures of China have to be understood. Since 1953, the Five-Year Plans (FYPs) have been the guideline of economic development in China, with the 12th FYP (2011–2015) currently being implemented. As explained by Wu (2007), the growth target being set up during the central planning era actually echoed the consequences of political game between lower level and higher level within the planning hierarchy. Because not achieving the planned target was politically unacceptable, the economic authorities at all levels tended to "leave room" for fulfilling annual and Five-Year Plans so they could easily meet or exceed their targets. However, when a great excess of actual growth above target growth in following years occurred, this would imply that the lower authorities might have left too much "room", so the central authorities would tend to set a new higher growth target for the succeeding plan. In such a case the new plan would then turn out only to be marginally overshot, arguably a signal from the lower authorities that such a high target was unmaintainable. Wu (2007) believes that such interactive process was the cause of volatile macroeconomic performance during the central planning era. In the early 1990s the situation began to change because market system was allowed to play a more important role in the Chinese economy. With the aim of smoothing aggregate volatility, the authorities began to employ monetary and fiscal policies around the mid-1990s. Though the change in national plans was erratic during central planning era, the highly volatile macroeconomic performance resulted has indeed taught the later government a lesson: economic growth should not be too fast so that necessary macroeconomic balances can be maintained.

In particular, China's economic growth was found to have the cyclical stop–go pattern (Yusuf, 1994; World Bank, 1995), and several researches have tried to understand the cyclical behaviours. Yu (1997), for example, justifies the implementation of monetary policy by the Chinese government on controlling the economic fluctuations. Brandt and Zhu (2000, 2001), instead, seek to explain the growth cycle and inflation cycle, and argue that the cycles arise as a result of the imperfect control by the Chinese government over credit allocation. He, Chong, and Shi (2009) suggest the sources of economic volatility are inefficient factor utilisation and labour market rigidity, while Gong and Lin (2008) suggest that the overshooting in investment and the maintenance of high growth rate could be the drivers of the 'deflationary expansion' phenomenon in China. Xu (2002) and Xu and Voon (2003), by contrast, decompose the provincial growth rate into national, industrial and provincial effects in order to analyse the economic integration in China. While most researches were explored to explain the cyclical behaviours in China, recently Laurenceson and Rodgers (2010), based on the spectra analysis of macroeconomic factors, suggest that the reference to business cycle alone is not sufficient to understand the nature of China's macroeconomic volatility.

The brief discussion of the underlying drivers of economic growth and volatility behind the Chinese economy implies that it is essential to analyse the 'full' characteristics of China's GDP, rather than just the 'partial' information in the business cycle, in order to study the Chinese economics. Empirically, the temporal properties of China's GDP should be a reflection of China's history of economic development. However, the GDP data is actually the aggregate of all economic activities. The aim of this paper is therefore to detangle China's GDP into seasonal, short-term and long-term frequencies, so that the Chinese economic development could be further understood through the foundation of the characterisation. For economists, lack of suitable characterisation on China's output may mislead the theoretical economic studies on the Chinese economy as well as the global economy. Likewise, understanding the relative role of permanent versus transitory movements in the macroeconomic fluctuations of China's economy is also important for forecasters and policy makers, since China is the world's fastest growing and the second largest economy.

Several papers have also directly conducted econometric analysis on China's GDP. For example, Xu, Zhu, and Liu (2005) applied the Hodrick–Prescott filter for trend decomposition, Chen and Liu (2007) used a MSMV(3)–AR(2) model to examine the asymmetric business cycle, and Liu and Zheng (2008) used the threshold autoregressive model to describe China's business cycle.[1] By contrast, the econometric methodology employed in this paper is the structural time series model as referred to by Harvey (1989). Zheng, Teng, and Song (2010) used an unobserved component model similar to the methodology in this paper. However, their paper differs from ours in the following respects. First, their data is seasonally adjusted with Tramo/Seats method before the model is applied. Second, they use a random walk with drift model to catch trend behaviour, and third, they use a AR(2) process with a discrete state variable to catch asymmetric business cycle. Obviously from the setting, their purpose is to analyse the cyclical behaviour of China's GDP, so the cyclical component extracted by their model actually includes both the long-term economic growth of China that allegedly has the cyclical stop–go pattern, and the short-term business cycle that measures the temporary fluctuations around the permanent level.

With the objective of fully characterising China's GDP, this paper instead clearly distinguishes between the short-term business cycle and the long-term growth cycle. To this purpose, we use the local linear trend model to catch the trend behaviour, and therefore the trend component extracted by our model would capture the low frequency volatility of GDP. Furthermore, the slope of the local linear trend model also allows us to catch the long-term economic growth and hence, the stop–go pattern of the growth cycle. To catch the short-term business cycle that measures output gap, we use the trigonometric expression, which

[1] These three papers are written in Chinese.