Economic Modelling xxx (2018) 1–13

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.journals.elsevier.com/economic-modelling

China's increasing global influence: Changes in international growth linkages☆

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ARTICLE INFO

JEL classifications:
C32
E32
F43

Keywords:
China
International growth
Structural breaks
Globalisation

ABSTRACT

Changes in linkages between growth in the USA, Euro area and China are investigated utilising an iterative procedure for detecting structural breaks in VAR coefficients and disturbance covariance matrix. We find dynamics to be unchanged and, accounting for volatility changes, cross-country correlations are constant until the end of 2007. Although largely isolated from the other large economies until 2007, growth in China is subsequently strongly related to that of the US and the Euro area. The effects are illustrated using generalised impulse responses and forecast error variance decompositions. The increased international synchronisation found may be associated with the effects of the Great Recession on the US and Euro area together with China's extraordinary export growth since joining the World Trade Organisation in 2001.

1. Introduction

The economic rise of China over the last four decades is well-documented, with its share of world GDP rising from less than 2% in 1979 to almost 15% in 2016, alongside its share of world trade in the export of goods increasing from 0.8% in 1979 to 13% in 2016.[1] Indeed, China overtook the US in 2007 to become the world's largest exporter of goods. Although relatively few studies focussed on the role of China in the international economy until its rise was cemented by overtaking Japan as the world's second largest economy in 2009 (by share of world GDP), it is now attracting a great deal of attention. For example, recent studies undertaken within the IMF examine the nature and extent of international spillovers from China, including Arora and Vamvakidis (2011), Blagrave and Vesperoni (2016) and Furceri et al. (2017). Other authors, including Cesa-Bianchi et al. (2012), Dreger and Zhang (2014), Osborn and Vehbi (2015) and Pang and Siklos (2016), also examine how shocks to growth in China affect other economies, while related studies focus on the role played by China for exchange rates and inflation (for example, Granville et al., 2011, Metelli and Natoli, 2017). Although much of this work is motivated by the growing importance of China, empirical analyses nevertheless typically assume constancy over time.

The aim of the present paper is to inform discussion about the nature and timing of any change(s) in growth relationships across the world's major economic blocks by applying formal structural break tests to a VAR model for GDP growth in the US, China and the Euro area. Previous studies that consider time-variation in China's relationship with other economies include Fidrmuc et al. (2014), Furceri et al. (2017) and Osborn and Vehbi (2015), but the methods they employ are not designed to pinpoint the nature of change and when this occurred. However, through a structural breaks analysis, we examine evidence for change in the cross-country dynamics of growth, its volatility and the strength of contemporaneous growth linkages. Although methods such as random coefficient models and rolling regressions can be employed

☆ We thank Dick van Dijk for his invaluable comments on the earlier version of the paper. This paper has also benefited from the comments received at the Royal Economic Society Conference, SETA-2015, 16th KAEA-KEA International Conference and seminars at the Mongolian Economic Association, National University of Mongolia, Korea University, Yonsei University and University of Seoul. The authors would also like to thank the Editor and three anonymous referees for helpful suggestions that have significantly improved the paper. Funding: This work was supported by the National University of Mongolia [grant number P2017-2466]; and Economic and Social Research Council Rising Powers project [grant number ES/J012785/1].

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[1] Figures in this discussion employ GDP data from the World Bank and trade data from the World Trade Organisation.

https://doi.org/10.1016/j.econmod.2018.05.014
Received 27 June 2017; Received in revised form 13 March 2018; Accepted 10 May 2018
Available online XXX

to capture change, we prefer to take a structural breaks perspective because it does not require *a priori* assumptions about the existence or timing of change, and hence may be particularly useful for examining the emergence of China as an economic force. The implications of the breaks we uncover are explored through impulse response functions and forecast error variance decompositions. Following Diebold and Yilmaz (2015), our principal results are not based on any assumed cross-country causal ordering for growth 'shocks', but employ the generalised techniques of Koop et al. (1996) and Pesaran and Shin (1998).

We employ quarterly data over 1975 to 2015, allowing us to focus on changes in international growth affiliations in the post-Bretton Woods period. Although there would be some advantages in expanding the analysis beyond the US, the Euro area and China, difficulties associated with econometric inference for multiple breaks in a system with a limited amount of data means that parsimony is required in the number of economies included. We study the Euro area as an aggregate, in order to recognise the international importance of this economic region, with aggregate output comparable to the US. Breaks are examined within our three equation system using the iterative testing procedure of Bataa et al. (2013), which not only separates coefficient and covariance breaks, but also further decomposes covariance breaks into variance and correlation breaks. While the broad approach is similar to that employed by Doyle and Faust (2005), who study changes in linkages between G7 countries, ours is more flexible in that we neither specify *a priori* the number of breaks nor are coefficient and covariance breaks required to be contemporaneous. Further, we separate correlations from volatilities, which is crucial since the former measure the strength of contemporaneous linkages, whereas volatility changes may arise from purely domestic factors.

Our results imply that breaks in the contemporaneous correlations of 'shocks' are the most important feature of changing international growth affiliations. More specifically, a correlation break around 2007 evidences the growing importance of China, with substantially increased comovement across the three economies after this time. On the other hand, no changes in cross-country dynamic interactions (breaks in the VAR coefficients) are found. Due to the greater integration of China into the international economy, the effect of a one standard deviation 'shock' to its growth is associated with strong growth effects for both the US and the Euro area, whereas growth in China was largely isolated from these other economies until 2007. However, the greater integration of China also has the consequence that its growth volatility is also now more closely associated with growth shocks from these other economies. The structure of this paper is as follows. Section 2 discusses data, with Section 3 then outlining our methodology for measuring linkages; an example of the role of volatility breaks and an overview of the methodology employed for econometric inference can be found in the Appendix. Our principal results on growth linkages are presented in Section 4, while Section 5 provides some discussion and conclusions.

2. Data

Our analysis employs quarterly real GDP growth rates of the US, Euro area and China over the period 1975Q2 to 2015Q2. All data are seasonally adjusted and, except for China before 2011, obtained from the OECD database.[2] Data for China starts in 2011Q1 in that database, with growth rates for the earlier period computed using Abeysinghe and Rajaguru's (2004) estimates of real seasonally adjusted quarterly GDP for China. Abeysinghe and Rajaguru (2004) interpolate available annual data through the Chow-Lin technique that exploits information in related quarterly series (namely M1 and total external trade) and observed autocorrelation, and hence the estimated values are anticipated to be more reliable than those based on univariate interpolation. We acknowledge that there is widespread doubt about the quality of historical data relating to the Chinese economy; see, for example, the study of quarterly GDP by Franses and Mees (2013). Nevertheless, there is little that individual researchers can do beyond working with the available data and, despite its limitations, we consider this data to be sufficiently reliable to show the patterns of growth in the real GDP of China.

Of course, the Euro area came into existence only in 1999 and its membership has expanded since that date. To maintain a consistent composition, our Euro area data relate to the original 'Euro 12' (denoted EU12), namely the twelve countries that comprised the Euro area at the launch of the physical notes and coins in January 2002.[3] EU12 is used in preference to an aggregate for the entire Euro area because of the changing country composition of the latter. The growth rate in each case is measured as 100 times the first difference of the log real GDP values.

Alongside positive association between US and EU12 growth rates, the rise of China is evident in Fig. 1, with its growth rate typically being substantially above than the others since at least the early 1980s. The Great Recession is clearly visible as a decline in growth for each country around 2008/2009, albeit with that for China remaining positive. The figure also indicates that all three economies may have experienced changes in the volatility of growth over our sample period. Although some changes in patterns may be seen in the figure, it is nevertheless important to undertake formal analysis in order to confirm (or otherwise) their nature, since they could be due to random variation rather than changes in the underlying process.

Our analysis employs the quarterly growth rates of Fig. 1. Although some researchers filter GDP growth rate data in order to remove very short run fluctuations and hence concentrate on the so-called business cycle frequencies, such filtering has substantial consequences for the dynamics of the process and hence we prefer to analyse unfiltered growth rate data.

3. Measuring growth linkages

As already explained, our analysis is based on a VAR model for GDP growth in the US, Euro Area and China. In common with many VAR analyses, we employ the tools of impulse response functions and forecast error variance decompositions in order to examine the nature of interactions across variables (in our case, the three economies). However, our analysis is distinctive in two respects. Firstly, employing the methodology of Bataa et al. (2013), we examine whether changes have occurred in the parameters of the VAR; details of the procedure can be found in that paper and is outlined in Appendix 6.2. Sufficient to note here that, although Doyle and Faust (2005) find evidence of breaks in both the VAR coefficients and the covariance matrix for international output growth, such breaks need not occur with the same frequency or at the same dates, as they assume. Previous studies focusing on the univariate properties of output growth imply volatility declines might be anticipated in the early 1980s (see, for example, Sensier and van Dijk, 2004), whereas globalisation may affect dynamic linkages and contemporaneous correlations from the latter part of the century (Kose et al., 2008). Therefore, our analysis first examines whether the coefficients, disturbance volatilities and correlations of our VAR change over time.

The second distinctive feature of our analysis is that, when comparing effects over different sub-periods, we allow shocks across economies

[2] The OECD is one of a number of international organisations which publishes data collected by the national statistical agencies for a range of countries.

[3] These 12 Euro member countries are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. The series used is labelled VPVOBARSA in the OECD database, which is expressed in millions of US dollars, volume estimates, fixed PPPs and in annual levels. A single series for EU12 is not available, with our series obtained by subtracting the Denmark, Sweden and UK series from that for EU15.