Journal of International Money and Finance 81 (2018) 20–39

Contents lists available at ScienceDirect

Journal of International Money and Finance

journal homepage: www.elsevier.com/locate/jimf

Measuring the international dimension of output volatility

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ARTICLE INFO

Article history:
Available online 3 November 2017

JEL classification:
C32
E32
F44

Keywords:
Volatility
Business cycle
Bayesian model selection

ABSTRACT

This paper studies output fluctuations in a panel of OECD economies with the aim to decompose the evolution in output volatility into domestic and international factors. To this end we use a factor-augmented dynamic panel model with both domestic and international shocks and spillovers between countries through trade linkages. Changes in the volatility of output growth can be due to time-varying sensitivity to these shocks, changes in the propagation mechanism or shifts in the variances of shocks. We explicitly model cross-sectional dependence in the variance equation by specifying a common factor structure in the volatility of domestic shocks. The results show that while the size of international shocks and spillovers does not decrease in most countries, the volatilities of domestic shocks share a clear common decreasing trend. Hence, the 'Great Moderation' appears to be mainly driven by a decline in the volatility of domestic shocks rather than smaller international shocks.

1. Introduction

The sharp decline in output volatility in most advanced economies since the mid 1980s is one of the most striking stylized facts in modern macroeconomics. First documented for the US by Kim and Nelson (1999) and McConnell and Perez-Quiros (2000), the phenomenon has been so widespread and persistent that it was famously coined the 'Great Moderation' by Stock and Watson (2003). Although a large literature has already analyzed the potential sources and consequences of output volatility, this continues to be an area of lively debate.

One strand of the literature has focused on the fundamentals underlying the observed decline in aggregate volatility such as better monetary policy (Clarida et al., 2000), increased government size and fiscal policy (Fatas and Mihov, 2001), improved inventory management methods (Kahn et al., 2002), financial innovation and increased global integration (Dynan et al., 2006), or demographic changes (Jaimovich and Siu, 2009). Alternatively, the 'good luck' hypothesis brought forward by Stock and Watson (2003) entails the idea that the period from 1980 onwards has simply been characterized by the absence of large shocks hitting economies. Related to this is the question whether the recent Great Recession marks the end of the Great Moderation. While some authors confirm that this is indeed the case (see e.g. Ng and Wright, 2013), others consider it to be merely a temporary offset of the structural decline in volatility (see e.g. Clark, 2009).

Starting off from Blanchard and Simon (2001) who show that there has been a global decline in output volatility in G7 countries, with magnitude and timing differing across countries, a second strand of the literature tries to explain trends in aggregate volatility in terms of the 'geographic origin', i.e. to what extent these trends are driven by global or

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https://doi.org/10.1016/j.jimonfin.2017.11.001
0261-5606/

country-specific factors. Stock and Watson (2005) estimate a factor-augmented structural VAR where GDP growth is decomposed into common and idiosyncratic shocks as well as spillovers, i.e. shocks that originate in a certain country and subsequently spread to other countries. They find that a decrease in the size of global shocks is responsible for much of the observed decline in business cycle volatility in the G7. Carare and Mody (2012) add evidence that spillovers have become more important since the 1990s and acted as a volatility amplifier during the recent Great Recession. Using a dynamic factor approach, Kose et al. (2003) show that a common world factor is an important source of business cycle volatility in advanced economies. Extending their approach by allowing for time-varying factor loadings and stochastic volatility in the latent factors and idiosyncratic components, Del Negro and Otrok (2008) find no evidence of increased business cycle synchronization. In fact, their results document that a common drop in the volatility of country-specific fluctuations is an important feature of the Great Moderation, but they leave this aspect unmodeled.

In this paper we set up and estimate a factor-augmented dynamic panel data model with time-varying coefficients and stochastic volatilities to decompose aggregate output growth volatility in international and country-specific factors. More specifically, our encompassing empirical framework allows the moderation in volatility to be driven by (i) smaller international shocks; (ii) a moderation in foreign countries that spills over to the remaining countries; (iii) lower contemporaneous sensitivity to international and foreign shocks; (iv) a milder propagation of shocks over time; and (v) a common and/or idiosyncratic reduction in the volatility of country-specific shocks. Such a general decomposition has not been done before. Disentangling a country's output volatility into its constituent components is of particular importance for policy makers as it provides information on whether the observed change in output volatility is due to one of the country-specific components, which may be under their control, or due to international factors, which are not.

We contribute to the literature in the following three ways. First, we merge the factor-augmented VAR approach of Stock and Watson (2005), by decomposing output growth shocks into country-specific shocks, common shocks and spillovers, and the dynamic factor approach of Del Negro and Otrok (2008), by allowing for time variation in the variance of shocks and time-varying sensitivities to shocks. Second, we further extend these approaches by explicitly modeling a common factor in the volatility of domestic shocks. Hence, next to co-movements in countries' GDP through common growth shocks and spillovers, our model is also able to capture co-movement in the size of country-specific shocks. The idea to model a common component in the volatility of otherwise uncorrelated shocks is not entirely new. Kim et al. (2009) extract macroeconomic uncertainty as the common factor in consumption and dividend growth volatility. Laurini and Mauad (2015) include a common jump factor in a multivariate stochastic volatility model to account for crises and contagion in emerging countries' exchange rates markets. Herskovic et al. (2016) show that not only firms' returns but also their volatilities exhibit a strong common factor structure. However, to the best of our knowledge, we are the first to model a common factor in the volatility of domestic output growth shocks as one of the potential sources of the Great Moderation. Third, we explicitly address model uncertainty. We start by specifying all coefficients and variance parameters as random walks, but then go on and test which time-varying components are relevant model attributes and fall back to a more parsimonious model when appropriate. This not only avoids over-parameterization but will also provide us with information on which components actually contribute to changes in output volatility.

Using quarterly data on the growth rates of real output for 16 advanced countries over the period 1961:Q1–2015:Q4, we obtain the following results. First, the volatility of common shocks clearly varies over time - shooting up around the oil crises of the 1970s, the worldwide recession of the early 1990s and the recent Great Recession - but there is no marked evidence of a declining trend. As individual countries' sensitivity to the common shocks and spillovers has remained stable over the sample period, changes in the volatility of the international business cycle component is not what is driving the Great Moderation. Second, the volatility of domestic shocks shows a clear common downward trend across the 16 advanced economies we consider. We identify this as one of the main drivers of the widespread reduction in volatility. Finally, the Great Recession shows up as a temporary increase in the volatility of common shocks and hence does not mark the end of the Great Moderation.

The remainder of the paper is structured as follows: Section 2 introduces our empirical specification and estimation approach. The main estimation results are presented in Section 3 and further documented by means of variance decompositions in Section 4. Section 5 concludes. The appendix contains a detailed description of the estimation methodology.

2. Model and estimation approach

2.1. Empirical specification

Our starting point is the factor-augmented dynamic panel model proposed by Stock and Watson (2005) extended to allow for time-varying coefficients and stochastic volatilities as in Del Negro and Otrok (2008). More specifically,

$$\Delta y_{it} = \alpha_{it} + \sum_{j=1}^{p} \beta_{it}^{j} \Delta y_{i,t-j} + \sum_{k=1}^{q} \gamma_{it}^{k} \Delta y_{i,t-k}^{*} + \varepsilon_{it}, \tag{1}$$

where Δy_{it} is real GDP growth for country i in quarter t and Δy_{it}^{*} is trade-weighted real GDP growth of the trading partners of country i.