Journal of Empirical Finance 28 (2014) 90–103

Contents lists available at ScienceDirect

Journal of Empirical Finance

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

Timescale-dependent stock market comovement: BRICs vs. developed markets

Heikki Lehkonen *, Kari Heimonen

School of Business and Economics, University of Jyväskylä, P.O. BOX 35, FI-40014 Finland

ARTICLE INFO

Article history:
Received 21 June 2011
Received in revised form 15 March 2013
Accepted 10 June 2014
Available online 19 June 2014

JEL classification:
C22
C40
E32
F30
G15

Keywords:
International stock markets
BRIC
Comovement
Wavelets
Dynamic conditional correlation

ABSTRACT

This paper examines the differences in the asset return comovement of the BRIC countries (Brazil, Russia, India and China), the other developed economies in their regions (Canada, Hong Kong and Australia) and the major industrialized economies (the U.K., Germany and Japan) with respect to the U.S. for different return periods. The novelty of the paper is that the stock return indices are decomposed to several timescales using wavelet analysis and that the results are further used as inputs for the dynamic conditional correlation (DCC) framework, which is used as a measure of comovement. The results propose that the level of stock market comovement depends on regional aspects, the level of development and especially on the timescale of returns. These factors should be carefully considered in designing internationally diversified portfolios. The BRICs provide some portfolio diversification benefits, but it is not justifiable to treat all BRICs as a homogeneous group of emerging economies in terms of stock market comovement.

1. Introduction

Stock market interdependence has been recognized as an important topic in international finance in both the developed and emerging markets (see, e.g., Korajczyk and Viallet (1989), Chan et al. (1992), Bekaert and Harvey (1995), Foerster and Karolyi (1999), Dumas et al. (2003), Carrieri et al. (2004), Bekaert et al. (2005) and Carrieri et al. (2007)). One of the major motivations for these studies is the exploration of the level of comovement in the international stock market, which impacts the portfolio diversification and the stability of the global financial system, given that shocks to the stock market can quickly spread across the world.

Growing importance of emerging market for global portfolio allocation calls for further research on the stock market integration and comovement among the emerging markets.[1] The purpose of this study is to reveal the time-dependencies and the evolving nature of stock market correlation among the BRIC countries (Brazil, Russia, India and China), the other important economies in their regions (Canada, Australia and Hong Kong) and the major industrialized countries (Germany, the U.K. and Japan) with respect to the U.S. As a result, we are able to make inferences about whether BRIC countries' equity markets can be clustered into a single BRIC group and appropriate levels of stock market segmentation of BRIC countries compared to the U.S. and other major industrial economies. The

* Corresponding author. Tel.: +358 405767822; fax: +358 14617194.
E-mail addresses: heikki.lehkonen@jyu.fi (H. Lehkonen), kari.heimonen@jyu.fi (K. Heimonen).

[1] Market interdependence and high market comovement often refer to high correlations between returns in different markets. Although, Bekaert and Harvey (1997) and Morana and Beltratti (2008) propose positive correlation between the correlation and the degree of market integration, correlation should not be used as a direct measure of integration as shown for example by Pukthuanthong and Roll (2009). In this research, we make no difference between the concepts of market comovement, correlation, interdependency and integration.

http://dx.doi.org/10.1016/j.jempfin.2014.06.002
0927-5398/

analysis also provides some evidence of whether the stock markets could be divided into American, Asian and European regions. The time-dependence of the stock market comovement is carefully considered by combining wavelet analysis and dynamic condition correlation, which are relatively new techniques.

Emerging countries have received much interest during the last few decades, mainly because the economic performance of the BRIC countries has strongly exceeded the economic growth of industrialized countries.[2] For many years, economic growth and stock market performance in the BRIC countries have exceeded the figures produced in more advanced economies and they have been recognized as motors for global economic growth. It is expected that under favorable economic growth conditions, the combined economies of the BRICs could grow larger than those of the combined economies of the G6 nations (the U.S., Japan, Germany, France, Italy and the United Kingdom) in the U.S. dollar terms in less than 40 years. Even today, emerging nations' equity markets have significant, sizeable and persistent impacts on the global equity markets (see Cuadro-Sáez et al. (2009)).

Since Longin and Solnik (1995) and Bekaert and Harvey (1995), it is recognized that stock market correlations and integrations are time-varying. In addition, Rua and Nunes (2009) provide evidence that the degree of stock return comovement varies also across different return frequencies. The dynamicity of the integration is even more evident for the emerging countries, which have just recently opened their markets and are now gradually integrating into the global stock market, as shown for example by de Jong and de Roon (2005). The time-dependence of comovement is important for stock markets, as the market participants are a very heterogeneous group. Active investors, such as large investment banks, are more interested in short-term movements of the indices than more passive investors, such as the commercial banks, insurance companies, individuals and financial arms of non-financial corporations that pay more attention to the long-term performance of the portfolio balances. Thus, investors from different groups are also associated with different risk characteristics.

Because the correlation of stock returns varies over time, the investigation must be able to capture this time-varying feature. It has been generally accepted that multivariate models are appropriate for studying transmission mechanisms and correlation dynamics between the markets (Martens and Poon, 2001). Along these lines, Bhar and Nikolova (2009) study the level of correlation of the BRIC countries with their respective regions and the world using a bivariate EGARCH structure, which allows for a time-varying conditional correlation of the index equity returns. They use return and volatility spillovers as proxies for the level of integration and find that India has the highest level of integration on regional and global levels, followed by Brazil and Russia, while China shows no evidence of regional integration. The weaknesses of their study are that they do not identify the differences between short- and long-term integration and fail to indicate the dynamics of the integration process.

The novel contribution of this study is to combine two rather new techniques, wavelet analysis and dynamic condition correlation (DCC), to reveal the stock market interdependencies between the BRIC countries and the more advanced economies at different return frequencies. The differences and the time-varying nature of stock market comovement are examined using the wavelet-DCC analysis. The multiresolution analysis of wavelets filters and disentangles the national stock market dynamics at different frequencies. The filtered series are further used as inputs for the DCC model by Engle (2002). As a result, we are able to detect BRIC countries' stock market comovement at different frequencies and identify the timescales in which the comovement is higher and the benefits of portfolio diversification in terms of risk management are lower.[3]

We find that the dynamicity and strength of the correlation depend on the timescale of the returns such that for the lower timescales, the dynamicity is higher and the strength is lower than that for the higher timescales. The regional and developmental factors also play a role in stock market comovement. For the lower timescales, the clustering of Asian, European and American markets is justified, supporting the results of Groenen and Franses (2000), while for the higher timescales, the developmental factors begin to dominate as the developed markets become more interdependent than the BRICs. In general, we cannot find evidence of a positive time-trend in the correlations for the sample period.

The rest of the paper is organized as follows. Section 2 presents the measure of comovement and briefly describes the wavelet decomposition and the dynamic conditional correlation. Section 3 provides the data and the results, while Section 4 concludes.

2. Measuring the comovement

We study the emerging market time-varying stock market comovement in terms of the U.S. investor. Our contribution to the theories of market integration (see. e.g. Black (1974), Stulz (1981), Errunza and Losq (1985), Eun and Janakiramanan (1986), Bekaert and Harvey (1995), Cooper and Kaplanis (2000); and Hardouvelis et al. (2006)) is to introduce potential timescale-dependency to the integration process.

Investor's portfolio consists of assets with different investment periods and the total return of the portfolio is the sum of these individual components. Thus the return can be represented as

$$E_{t-1}\left(r_{i,t}\right) = \sum_{k=1}^{p} \eta_{d_k} E_{t-1}\left(r_{i,t}\right)^{d_k}, \tag{1}$$

[2] The abbreviation BRIC has become an everyday term among finance professionals, and it is expected that the importance of these countries will grow in equity portfolios. The term BRIC was made famous by Goldman Sachs' report by Wilson and Purushothaman (2003) and the follow-up paper by O'Neill et al. (2005).

[3] For the previously applications of wavelets for stock market integration, see Rua and Nunes (2009) who used continuous wavelet transform framework. Our discrete version enables us to study more carefully the trend, dynamicity and strength of the correlation structure. For other applications of wavelets for economic research, see e.g. Crowley and Lee (2005) who analyze the business cycles in the euro area and other industrialized economies.