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An analysis of dependence between Central and Eastern European stock markets

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ABSTRACT

We examine the dependence structure between four Central and Eastern European (CEE) stock markets (Czech Republic, Hungary, Poland and Romania) using static and dynamic copula functions with different forms of tail dependence. We find evidence of positive dependence between all CEE stock markets, although this dependence is stronger between the Hungarian, Czech and Polish markets than between these markets and the Romanian market. We also find evidence of symmetric tail dependence, although not for the Hungarian and Czech markets. The dependence is time-varying and intensified after the onset of the recent global financial crisis. These results confirm that CEE stock markets are gradually coupling, a fact that has risk management implications for policymakers and investors.

1. Introduction

Understanding how financial markets in transition countries in Central and Eastern Europe (CEE) co-move is a matter of concern for both investors and policymakers, given the crucial implications for portfolio risk management and the potential spillover effects of economic policies. We examine the conditional dependence structure between four Central and Eastern European (CEE) stock markets

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(Czech Republic, Hungary, Poland and Romania) with the aim of providing answers to the following compelling questions: Are CEE stock markets integrated? Does dependence change when markets experience extreme market movements? Is dependence symmetric or asymmetric? Has dependence changed since the onset of the recent global financial crisis? By answering these questions we hope to improve the understanding of stock market interdependence in the CEE economies.

Previous empirical research (see Section 2) has examined the relationship between CEE financial markets as well as their interdependence with other developed markets using different econometric techniques such as correlation analysis, co-integration theory, the Granger causality test, the vector autoregressive model and a variety of generalized autoregressive conditional heteroskedasticity (GARCH) models. However, little is known about the dependence structure of the CEE stock markets themselves. We attempt to fill this gap by examining the dependence structure between the Czech, Hungarian, Polish and Romanian financial markets, thereby contributing to the extant literature along two axes, namely, in our use of copulas and in our findings regarding stock co-movement in the CEE countries.

First, we used copulas to characterize the dependence structure for CEE stock markets because, compared to linear correlation, they are a more informative measure of dependence between two or more variables. This is because they provide both a complete description of the dependence structure and information on average and tail dependence (joint extreme dependence). Compared to parametric multivariate distributions, copulas offer a more flexible framework for characterizing dependence, given that marginal densities and dependence can be modelled independently. To the best of our knowledge, no study to date has examined conditional dependence in CEE stock markets using copulas. Avdulaj and Barunik (2013) investigated the international portfolio diversification benefits between the Czech and German stock markets using copulas and Aloui et al. (2013) used copulas to examine the impact of oil prices on stock market performance in CEE economies. However, neither of these studies considered co-movement between financial markets. Unlike these studies, we used different families of copulas with time-varying dependence parameters to study time-varying dependence and thus capture the impact of certain kinds of events, like financial crises, on the nature of dependence in four CEE financial markets.

Second, considering daily stock return data for the period June 2000 to September 2013, we found evidence of stock market co-movement that was stronger between the Czech Republic, Hungary and Poland than between these countries and Romania. Moreover, except for the Hungarian and Czech markets, which were marked by upper and lower tail independence, we found evidence of symmetric extreme market dependence between CEE stock markets as represented by the Student-t copula, indicating that a shock in one market is fully transmitted to the other markets. Finally, our evidence indicates that dependence evolved over time and, in particular, increased after the onset of the global financial crisis. Overall, our findings, which suggest that CEE stock markets have been gradually coupling, have implications for risk management, since investments in different stock markets in this region offer limited risk diversification and downside risk management opportunities. Our evidence also has policy implications, since the effects of policies implemented in one CEE country can be transmitted through the stock markets.

The rest of the paper is laid out as follows: in Section 2 we review the existing empirical literature on CEE stock market linkages and in Section 3 we discuss the copula methodology. We then describe the CEE stock markets and our data and discuss the main empirical results in Section 4. Finally, Section 5 concludes the article.

2. Literature review

The analysis of co-movement between international stock markets facilitates our understanding of financial shock spillovers and contagion phenomena[1]. Many studies employing copula functions for

[1] The transmission of shocks among financial markets is assumed to be greater in times of crisis due to the contagion phenomenon (generated by rumours, shrunken liquidity, market structure similarities, etc.). In addition, trade linkages favour the propagation mechanism of shocks (for a discussion, see Forbes and Rigobon, 2002). In this context, a huge body of literature shows that the volatility of financial markets increases in turbulence periods and the dependencies of stock returns move accordingly (Lin et al., 1994; Longin and Solnik, 1995, 2001; Chesnay and Jondeau, 2001; Baele, 2005; Morana and Beltratti, 2008; Sergey et al., 2010; Chang and Hsueh, 2013; Li and Zhang, 2013; Kotkatvuori-Örnberg et al., 2013; Taşdemir and Yalama, 2014).