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Dynamic correlation analysis of financial contagion: Evidence from the Central and Eastern European markets[☆]

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This paper applies the Dynamic Conditional Correlation (DCC) multivariate GARCH model of Engle (2002), in order to examine the time-varying conditional correlations to the weekly index returns of seven emerging stock markets of Central and Eastern Europe. We used weekly data for the period 1997–2009 in order to capture potential contagion effects among the US, German and Russian stock markets and the CEE stock markets. The main finding of the present analysis is that there is a statistically significant increase in conditional correlations between the US and the German stock returns and the CEE stock returns, particularly during the 2007–2009 financial crises, implying that these emerging markets are exposed to external shocks with a substantial regime shift in conditional correlation. Finally, we demonstrated that domestic and foreign monetary variables, as well as exchange rate movements have a significant impact on the corresponding conditional correlations. Macroeconomic fundamentals have been shown to have substantial explanatory power in explaining these conditional correlations during the financial crisis of 2007–2009.

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1. Introduction

It is well documented that stock return correlations vary over time. According to Ang and Bekaert (1999) and Longin and Solnik (1995, 2001), correlations among market returns tend to decline in bull markets and to rise in bear markets. Moreover, the fact that international stock market correlation is significantly higher during the periods of volatile markets (i.e. stock market crises periods) has become the accepted perception (Lin, Engle, & Ito, 1994). The global scale of the October 1987 stock market crash, the Asian crisis in 1997, and the Russian default in 1998 have created a growing impetus among researchers and policy makers to investigate the various aspects of international stock market relations, since the findings are significant both in application of passive and active international investment strategies and the identification of the channels of shock spreading from one market to the other. Low international correlation across markets is the starting place of global portfolio diversification strategy (Lessard, 1973; Solnik, 1974). If correlations between stock returns are high, a loss in one stock is likely to be accompanied by a loss in other

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stocks as well. Therefore, diversification benefits are greater when the correlation between the stock returns is low. On the other hand, the identification of significantly increased correlation of stock market returns can be regarded as evidence of existence of the contagion effect.[1]

The main body of the current literature explores the links among the developed stock markets (Hamao, Masulis, & Ng, 1990; Theodossiou & Lee, 1993; Longin & Solnik, 1995; Meric & Meric, 1997; Goetzmann, Li, & Rouwenhorst, 2001; Cappiello, Engle, & Sheppard, 2006; Kim, Moshirian, & Wu, 2005), while some recent studies have extended this line of research to the linkages between the emerging and developed stock markets (Bekaert, 1995; Bekaert & Harvey, 1995; Chen, Firth, & Rui, 2002; Yang, 2005; Chiang, Jeon, & Li, 2007; Phylaktis & Ravazzolo, 2005). However, even though most of the aforementioned studies have focused on emerging markets in Asia and Latin America, evidence on stock market linkages in the emerging markets in Central and Eastern Europe, remains relatively limited.

Gelos and Sahay (2000) investigated the impact of various external crises on Central and Eastern European (CEE) stock markets. They found increased financial market correlation since 1993, particularly around the time of the 1998 Russian crisis. The Hungarian market appeared to be highly affected by that crisis. This finding is consistent with Schotman and Zalewska (2006) who documented that the Hungarian market was the most, and the Czech market the least, sensitive to the 1997 Southeast Asian and 1998 Russian crises, a finding that may be explained by the fact that of the three emerging markets discussed in that study the Hungarian market had the highest foreign share ownership level and the Czech market the lowest. Moreover, Wang and Moore (2008) documented a higher level of stock market correlation between three emerging CEE markets and the aggregate eurozone market during the period after the Asian and Russian crises and also during the post-entry period to the European Union. Furthermore, Gilmore and McManus (2002) examined the short- and long-term relationships between the US stock market and three CEE emerging markets (Hungary, Poland, and Czech Republic) over the 1995–2001 period they found that low short-term correlations between the CEE markets and the US existed, whereas the application of the Johansen cointegration procedure indicated that there is no long-term relationship among them. Additionally, Scheicher (2001) found evidence of limited interaction between some of the CEE markets and the major markets for daily stock market volatility.

Voronkova (2004) showed the existence of long-run links between the UK, the German, the French and three Central European stock markets (Hungary, Poland, and Czech Republic), using daily data for the period 1993–2002, provided that structural changes are properly accounted for. In a similar vein, Syriopoulos (2004, 2007) documented the existence of a long-run relationship between the US, the German and four CEE stock markets (Hungary, Poland, Czech Republic and Slovakia), using Johansen's cointegration methodology over the period between 1997 and 2003, whereas he argues that CEE markets tend to display stronger linkages with their mature counterparts rather than their neighbors. Lucey and Voronkova (2008) examined the existence of Russian equity market linkages with several developed stock markets as well as with the equity markets of Hungary, the Czech Republic and Poland before and after the 1998 crisis. They employed alternative cointegration techniques using data up to 2004 and concluded that Russia does not show strong evidence of increased long-run convergence, either with regional or developed markets. However, when they examined the existence of short-run linkages using the DCC–GARCH model, they showed that conditional bivariate correlations have increased in the post-crisis period as compared to the pre-crisis period. Finally, Syllignakis and Kouretas (2010) provided evidence that the stock markets of the Central and Eastern European countries are partially integrated with the mature US and German stock markets, since they share a significant common permanent component which drives the system of these stock exchanges in the long-run, with the Estonian market appearing to be segmented. Furthermore, they also argued that the 2007–2009 global financial turmoil had a negative effect on the convergence process.

The issue of contagion among stock markets has come to the surface once again as a result of the financial crisis of 2007–2009. The CEE countries have been hit dramatically by the events that originated in the US sub-prime mortgage market that eventually turned into a credit and financial crisis. Thus, as a result of the 2007–2009 financial crisis, investors in the over borrowed speculative hedge funds and private equity and other institutional investors have withdrawn almost all their investments from the emerging markets and certainly from the CEE stock markets. Facing bankruptcy, these institutional investors moved to liquidate most of their stocks, bonds and currencies from the CEE and other emerging markets and invested instead in safer assets like US government bonds. As a result, the stock markets of the CEE countries lost over 50% of their value between June 2008 and November 2008 while their currencies have been devalued substantially.

Hungary is the country which was hit hardest by the crisis and faced severe economic and financial problems. It had a huge current account deficit and was forced to raise its basic interest rate from 8.5% to 11.5% in an effort to prevent the depreciation of the Hungarian fiorin. However, this intervention policy did not work and its currency continued to depreciate against the euro and the dollar. This fall in value of the domestic currency resulted in a substantial increase in the value of its external debt, forcing Hungary to ask for a 16.5 billion dollar loan from the IMF and another 5 billion euro loan from the ECB in an attempt to ease the severe consequences for its economy. Almost all other CEE economies faced significant problems. Estonia also faced an economic recession whereas the Romanian currency depreciated from May 2008 to November 2008 as a result of the substantial increase in its budget deficit, its current account deficit and its external debt which led to the reduction of its credit ratings by Standard and Poor's and Fitch. Even the currencies of Poland and the Czech Republic, which in the previous years were quite stable, went under substantial pressure due to the capital flight which led to a reduction in their values against the euro.

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[1] Forbes and Rigobon (2002) define contagion as significant increases in cross market co-movement, while any continued high degree of market correlation suggests strong linkages between the two economies and is considered to be interdependent. Therefore, the existence of contagion must involve a dynamic increase in correlation in the aftermath of a crisis event.

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