Journal of International Money and Finance 37 (2013) 353–370

Contents lists available at SciVerse ScienceDirect

Journal of International Money and Finance

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

Dynamic stock market covariances in the Eurozone

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JEL classification:
C51
C58
G15

Keywords:
Dynamic conditional correlation
Multivariate GARCH
International stock market integration
European Monetary Union

A B S T R A C T

This paper examines the short-term dynamics, macroeconomic sensitivities, and longer-term trends in the variances and covariances of national equity market index daily returns for eleven countries in the Euro currency zone. We modify Colacito, Engle and Ghysel's Mixed Data Sampling Dynamic Conditional Correlation Garch model to include a new scalar measure for the degree of correlatedness in time-varying correlation matrices. We also explore the robustness of the findings with a less model-dependent realized covariance estimator. We find a secular trend toward higher correlation during our sample period, and significant linkages between macroeconomic and market-wide variables and dynamic correlation. One notable finding is that average correlation between these markets is lower when their average GDP growth rate is lower or when more of them have negative GDP growth.

1. Introduction

This paper explores the changing magnitude of equity index return volatilities and correlations within the Eurozone, both in response to dynamic variation in the economic environment and in response to secular trends toward greater capital market integration. Although there are other regional economic co-operation agreements around the globe, the Eurozone is unique in the depth and breadth of its economic and financial integration, including the use of a common currency. This paper analyzes the equity market risk dynamics of this uniquely integrated regional capital market.

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http://dx.doi.org/10.1016/j.jimonfin.2013.06.008

We use the MIDAS-GARCH model of Engle et al. (2008) to model the dynamic volatilities of the daily returns of eleven Eurozone stock market indices. As in Colacito et al. (2011), we combine the MIDAS-GARCH model with the Dynamic Conditional Correlation (DCC) model of Engle (2002) to model the dynamic correlation matrix of the returns. We modify the DCC model to include a new univariate measure of multivariate correlation magnitude. With this simplified DCC model, which is a special case of Engle's more general specification, we analyze the relationship between macroeconomic variables and the time-varying correlations between Eurozone markets.

As a robustness check, we also apply less model-dependent realized covariance estimators, together with the same univariate measure of correlation magnitude, and find reasonably consistent empirical results.

We find that there is a strong positive trend toward higher correlation magnitudes across these Eurozone markets over our sample time period. We find some evidence for a "downside correlation" effect, so that, ceteris paribus, Eurozone markets seem to be more correlated when recent cumulative returns are on average lower within the region. Interestingly, correlation magnitude varies positively with Eurozone GDP growth measures. In one specification of this effect, we find a negative link between Eurozone business downturns (the proportion of markets with negative quarterly GDP growth rates) and correlation magnitude. In an alternative, related, specification correlation magnitude is higher during quarters when the cross-country average quarterly GDP growth rate is higher.

We find evidence for a positive dynamic link between cross-market average variance and correlation magnitude within the region. This result holds using either a rolling-window-based sample variance or a forward-looking variance based on the Eurostoxx volatility index.

Our paper is related to several strands of the research literature. One topic of considerable interest concerns the level and secular trend in international capital market integration, e.g., Lessard (1974), Heston and Rouwenhorst (1994), Drummen and Zimmerman (1992), Beckers et al. (1996), Rouwenhorst (1999), Hopkins and Miller (2001) and Griffin and Karolyi (1998). Much of the work in this area has focussed upon European markets, reflecting the continent's six-decade experiment in politically-led regional economic integration.

Another relevant research strand examines international spillover effects in stock markets, e.g., King and Wadhwani (1990), Hamao et al. (1990), Baillie et al. (1993), Engle et al. (1994), Booth and Tse (1996), and Goetzmann et al. (2005). Related to this is the accumulated evidence that correlations between financial markets are significantly higher during periods of volatile markets, as in Ang and Bekaert (1999), Longin and Solnik (1995, 2001), and Cappiello et al. (2006), and higher during "down" markets than during "up" markets, as found by Erb et al. (1994), Longin and Solnik (2001) and De Santis and Gerard (1997). Another related research area concerns empirical examination of the relationships between macroeconomic variables and stock market volatility, e.g., Officer (1973), Schwert (1989), Hamilton and Lin (1996) and Brandt and Kang (2004).

In terms of econometric technique, we utilize a covariance-stationary, two-component GARCH-type model. The component specification distinguishes between short- and longer run sources of volatility. Engle and White (1999) proposed a GARCH model with a short and long run component. Various two-component volatility models have been proposed by Ding and Granger (1996), Chernov et al. (2003), and Adrian and Rosenberg (2006). The MIDAS-GARCH component model was inspired by two earlier contributions, Ghysels et al. (2005) on MIDAS filter and Engle and Rangel (2008) on spline-GARCH. Engle et al. (2008) formulate the MIDAS-GARCH component specification that we employ.

For correlation modeling we use a variant of the Dynamic Conditional Correlation (DCC) model. Bollerslev (1990) develops a multivariate time series model with time varying conditional variances and covariances, but constant conditional correlations. Building upon this, Engle (2002) proposed the DCC model, in which conditional correlation is also time varying. Colacito et al. (2011) utilized these specifications and proposed a new class of component correlation models, the DCC-MIDAS correlation models. Our paper extends the DCC model by imposing a one-dimensional structure on the multivariate dynamic correlations. We find that our model is numerically easy to estimate by maximum likelihood, at least in the case of a modest number of asset returns (there are eleven assets in our application to Eurozone equity market indices). This may be due in part to the simplified one-dimensional dynamic correlation measure which we introduce in this paper.