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Dynamic Condition Correlation Implication for International Portfolio Diversification "The Case of German and French 1999-2008"

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ملخص

تهدف هذه الدراسة أساسا لدراسة الارتباط الشرطي الديناميكي بين الأسواق المالية الألمانية والفرنسية (DAX30) و (CAC40) من خلال تطبيق نموذج (DCC). وقد بينت النتائج وجود ارتباط عال بين مؤشر كل من DAX30 وCAC40 وهذا قد يرجع إلى تثبيت أسعار الصرف بين أسواق الأوراق الم الية الألمانية والفرنسية في عام (1999) إضافة إلى الاتحاد النقدي بين هذه الدول والذ ي أدى إلى زيادة التكامل الحقيقي بينهما، وهذا يتفق مع النتائج التي وجدها كل من (2002) Cappiello.et.al, (2003), and Bale.

كما أن استراتيجيات التنويع بين الأسواق المالية الألمانية والفرنسية أصبحت أقل جاذبية بسب الارتباط العالي بينهما، وزاد الارتباط الشرطي بين مؤشرات الأسواق الألمانية والفرنسية في منتصف فترة الدراسة.

Abstract

This study aimed mainly to examine the Dynamic conditional correlation between German and French stock markets. This issue is carried out through Dynamic Conditional Correlation (DCC). The empirical results showed that DAX30 and CAC40 are highly correlated and this may be due to fixing of the exchange rates between Germany and French stock markets in (1999); in addition to the monetary union has strengthened real integration among its members. This confirms the results reported by Cappiello, et, al. (2003) and Bale 2002.

So diversification strategies based on German and Frensh market are now less attractive. We found that conditional correlation among DAX30 and CAC40 indexes have substantially increased in the mid-period of the study.

Key Words: Stock Returns, Dynamic Conditional Correlation, Multivariate GARCH, Portfolio Diversification.

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1. Introduction:

Fundamental principal of financial theory says that portfolio diversification allows the investor to earn higher returns for each unit of risk and leads to greater portfolio performance, (Grubs and Levy 1968).

The typical international equity portfolio manager divides his portfolio into a number of regions and countries. This provides asset diversify within each country and international diversification across countries. Two features of this strategy: The first related to the expected return. This suggests that efficient investment strategy would have fund managers buying the market index in each country. The second is related to risk. Financial analysts, portfolio managers are well aware that in time of financial crises, stock market correlations tend to increase at precisely the time when portfolio managers are most heavily reliant upon them to contain the risks in their market positions.

This study intends to investigate the Dynamic Conditional Correlation of the underlying assets, it also addresses the issue of whether the correlation increase between underlying assets which has important practical and theoretical implications in particular, if the integration increase between German and French stock markets then asset diversification involving the two markets would lose much of its appeal. From theoritical perspective a higher degree of correlation suggests that multinational version of the capital asset pricing model may be more appropriate model of analysis than domestic version commonly used.

The study contributes to the literature by relaxing the assumption that correlation between assets is constant with respect to time and by applying the recently developed dynamic condition correlation (DCC) model of Engle (2002) and develop by Sheppared (2002) .

This study focuses on western European countries, as this region has gone through a unique period of economic financial and monetary integration. The indices of this research are basically designed to reflect the largest firms. The DAX-30 is a price- weighted index of the 30 most heavily traded stocks in German market, while CAC-40 calculated on the basis of 40 best French titles listed on Paris bourse.

The rest of the paper is organized as follows: Section II is devoted to present the review of literature; section III present methodology; section

IV contains the details of data source; section V dynamic condition correlation; and section VI is a conclusion**.**

II. Literature Review:

A Fundamental principle of financial theory, dating back to Markowitz (1952), is that portfolio diversification allows an investor to earn higher returns for each unit of risk and thereby leads to greater portfolio performance. Levy and Sarnat (1970), Lessard (1973), Solnik (1976), and Grubel (1968) were among the first to show that diversification across international assets increased these benefits due to their relatively low correlation compared to those of domestic stocks. Grauer and Hakansson (1988), De Santis and Gerard, (1997) Levy and Lerman, (1988) have argued that benefits are still present despite increasing integration across financial markets in both stock markets.

Atteberry and Swanson (1997) presented a research and its finding are consistent with a previous study by (Medewitz, et al. 1991) which concluded that the performance of equity markets is becoming increasingly synchronized, that is, the correlation coefficients of national market index returns are increasing over time, and the markets are becoming more integrated. So the potential for the benefits from international diversification is decreasing.

On other hand, Thomas and Flavin (2004) examined the relative importance of country and industry effects in European portfolio diversification and the impact of the Euro on this. They found that in the purely post-Euro sample industry effects outweigh country effects and hence industrial diversification is more likely to confer greater portfolio performance on the investor. On average, correlations between national stocks markets in this area have decreased by less than cross-industry correlations.

In another study Kearney and Poti (2003), prepared the model of the time series behavior of stock market correlation, by applying the recently developed dynamic conditional correlation generalized autoregressive conditional heteroscedasticity (DCC- GARCH) model, of (2001 Engle) and Engle and Sheppard, (2002) to capture the behaviors of overall market correlations and firm-level correlations in European stock markets.

Those researchers found weak evidence of an upward trend in the average conditional correlations among the 42 stocks included in the sample.

Moreover, the estimated average firm level conditional correlation does not increase sharply over the sample period. This is good news for asset allocation and portfolio management, since the lower average correlation the greater the gain from portfolio diversification.

This compares with the sharp increase in the average conditional correlation at the market index level. So, they preliminary conclude that while firm level diversification strategies retain their appeal, diversification strategies based on market indexes are now less attractive because of the increased correlation among the EMU stock markets.

This study tries empirically to examine Dynamic Conditional Correlation between German and French stock markets, long-run and short-run relationship between the two stock markets.

III. Econometric Methodology:

This study examines time-varying correlation between German (DAX30) markets and French (CAC-40) markets for this purpose, class of multi-variate GARCH models of Engle (2002) have been used in this study.

To investigate how the DCC model is implemented, consider:

$$rt|\Im t\text{-}1 \sim N(0, Ht)$$

$$H_t = D_t R_t D_t$$

Where r_t is the k×I vector of zero mean return conditional on the information set available at time t. R_t is the time-varying correlation matrix.

D_t is k×k diagonal matrix with time-varying standard deviations estimated by univariate GARCH model applied to each single time series.

The correlation matrix containing the conditional correlations can be seen from rewriting this equation $H_t = D_t R_t D_t$ as $et = Dt^{-1} rt$,since $E\ t_{-1}$ $(e\ t\ e\ ^{t}_{t})^{=} R\ t$

The estimation procedure of the simple DCC model is described in (Engle 2002) as follows: The first step the univariate GARCH volatility

models will be estimated for each of the k assets and in the second step transformed residuals from the first step are used to obtain conditional correlation estimator.

In the first step, the time-varying volatility is estimated by the univariate GARCH(p,q) model represented by the following equation:

$h_t = \omega + \sum \alpha_i r^2_{t-i} + \sum \beta_j h_{t-j}$ .....(1)

Once the univariate volatility models are estimated the standardized residuals for each market is used to estimate the dynamics of the correlations. The DCC model of (2002 Engle) specifies the dynamics of correlation structure for returns as follows

$Q_t = (1- a – b) Q^{-} + a\varepsilon_{t-1}\varepsilon'_{t-1} + b\, Q_{t-1}$ …. (2)

Rt= Q*t-1 Qt Q*t-1 …… (3)

where a and b are scalar parameters to capture the effects of previous shocks and previous dynamic conditional correlations.

IV. Data:

The data consist of daily prices use weekly or monthly, rather than daily data, limit the ability of the models to capture multivariate dynamics, also time zones differ across markets (Marton and Poon, 2001).

The study follows (Cappiello, l.et.al.2003) (Christos, S.et al. 2005), (Eun and Shim 1989) and (Andersen and Bollerslev, 1997) use daily indices data recorded at 16:00 London time of DAX-30 (German), CAC-40 (French).

The study used 16:00 London time in order to avoid the problems of non-synchronous data (see Marton and Poon 2001). The period of data is chosen to include financial crises events. The period span from 1990 to April 2008.different holidays applies for each market. The researchers sidestep this problem by taking the holiday price as being the same as the previous day. Hence, the sample for each country contains all days of the week except weekends.

The data are obtained from the DataStream. This is an international organization which publishes stock market data for most if not all major stock markets in the world. Following Koutmos (1996) and De santis and Imrohoroglu (1997), returns are measured in home-country currencies to incorporate hedging activities of investors against foreign

exchangerate risk. In the empirical studies below, returns are expressed in first differences of log prices to approximate continuously compound returns.

The first phase of this study analysis is based on descriptive statistics of the returns.

Table (1) presents summary statistics, all the series seem to display "stylized" facts common to many financial assets such as nonnormality in the form of fat tails. As indicated by skewness statistics, DAX30 and CAC40 returns seem to be positively skewed which indicates along right tail in empirical distributions, Kurtosis behavior is apparent in DAX30, and CAC40.

Also, the Jarque-Bera test which combines the skewness and kurtosis result, indicates that the hypothesis of normality is rejected decisively for all return series at 5% level.

The analyzed series presents a slight right asymmetry, therefore, the frequency distributions of returns are no Gaussians but leptokurtic and slightly asymmetric; therefore in this case the univariate specification GARCH (1, 1) is very significant to estimate the time-varying conditional volatility of observation time series.

The Jarque-Bera test strengthens this condition, rejecting the null hypothesis of normality at 5% level for all series.

Table (1): summary statistics of prices.

	DAX 30	CAC 40
Mean	3831.315	3390.298
Median	3850.510	3255.720
Maximum	8064.970	6922.330
Minimum	1420.300	1611.040
Std. Dev.	1645.744	1347.772
Skewness	0.385184	0.585887
Kurtosis	2.175296	2.418983
Jarque-Bera	194.5431	261.2995
Probability	0.000000	0.000000
Sum	14045600	12428832
Sum Sq. Dev.	9.93E+09	6.66E+09
Observations	3666	3666

Source: researcher calculations.

The second phase of this analysis is based on estimating the unconditional correlation for the sample. Correlation coefficient between the indices provides a useful measure on the long-run relationship between indices, and cornerstones for asset allocations. Table (2) shows that German and French stock markets are highly correlated with each other and this may due to the fixing of the exchange rates between Germany and France in 1999, and to the monetary union which had strengthened real integration among its members Frank and Ross (1997), which is consistent with increase economic and financial integration between these countries. This confirms the results reported by Cappiello, et, al. (2003); and it is consistent with the increase in the intensity of volatility spill over effects within EMU countries noticed by Bale, (2002). Furthermore Taylor and Bartram, (2005), confirmed the above results, but only for large equity Europeans markets.

Table (2) unconditional correlation coefficient for our sample

	CAC 40	**DAX 30**
CAC 40	1	.972
DAX 30	0.972	1

Source: researcher calculations.

Univariate GARCH:

When investigating the DCC across countries, it may be useful - before caring out the estimation of the multivariate GARCH specification, to estimate a univariate GARCH model, from which we can extract the estimated volatility of the individual stock markets. The univariate GARCH models is used to estimate the conditional volatility of each single data series. Researchers examining high-frequency financial data have suggested that volatility dynamics may be confounded by the existence of both a periodic pattern and long-memory volatility.

Thus, the researchers derived by far the most successful volatility forecasting model is the GARCH (1, 1) Bollerslev (1986), whose variance σ_t^2, represented by:

$r_t = \mu + \varepsilon_t$ Where $\varepsilon_t \sim N(0, \sigma^2)$ $\sigma\varepsilon t2 = \kappa + \alpha\varepsilon t\text{-}12 + \beta\ \sigma\varepsilon t\ \text{-}12$

Subject to $\kappa > 0$, $\alpha, \beta \geq 0$, $\alpha+\beta < 1$

Coefficient α and β determine the short run dynamics of the resulting volatility time series. A large β indicates that shocks to conditional variance take along time to dissipate, that is, volatility is said to persistent.

A large α indicates that volatility reacts intensely to market movements.

Table (3) shows the results of univariate GARCH (1, 1) estimation. All parameters are significant at 5% level. All series exhibit significant volatility persistence as indicated by large GARCH parameter estimates (β parameter in the last column in table 3) which indicates that shocks to conditional variance take along time to dissipate.

Although the GARCH model captures thick tailed returns and volatility clustering phenomenon that are evident in financial returns, it is unable to account for any asymmetric response of volatility to positive and negative shocks, since the conditional variance is function of the magnitude of the lagged residuals not their signs.

Table (3) univariate GARCH (1, 1) estimation results.

	μ	κ	α	β
DAX30	.0524(.0215)	.0376(.0051)	.0728(.0063)	.9240(.0079)
CAC40	.0411(1.7466)	.4456(.0065)	.0622(.0070)	.9370(.0098)

Source: researcher calculations.

Notes: the model is $r_t = \mu + \varepsilon_t$, $\sigma_t^2 = \kappa + \alpha\varepsilon_{t-1}^2 + \beta\,\sigma_{t-1}^2$.

Standard errors are in parentheses.

V. Dynamic Conditional Correlation:

The plot of the conditional correlation series is presented in figure (1).the first important feature is that the correlations between French and German market indices have increased since mid-sample period, which is obviously influenced by the fixing of the exchange rates in 1999 between the two countries and after the launch of Euro Monetary integration affects stock market return correlations in several ways. First, lower exchange rate volatility means lower transaction costs in cross-border investment. Furthermore, participation into a monetary union implies a single monetary policy and convergence in inflation

expectations. Consequently, real risk-free rates will converge and lead to more homogeneous valuations.

Second, lower exchange rate volatility could lead to enhanced business cycle synchronizations, thereby leading to higher stock market comovements.

Conversely, monetary authorities could use exchange rate flexibility to reduce the macroeconomic effects stemming from the transmission of country-specific real shocks, thereby delivering lower output co-movements across countries.

So diversification strategies based on market indexes are now less attractive because of the increased correlation among the two stock markets, which is consistent with Gikas et. Al (2006).

Finally according to persistence from our estimation results of the DCC parameter in table (4) we observe that the sum of a and b in equation (2) is very close to one (Where a and b are scalar parameters to capture the effects of previous shocks and previous dynamic conditional correlations) i.e. stocks to the correlation are very persistent, thus indicating that the process might not be stationary. Therefore, we can reject the presence of deterministic time trend, but there is evidence that the market indexes correlation is influenced by a stochastic trend.

This brings us to a specification which is based on the fact that the sum of the parameters is one and the process of the correlations is integrated of order one, as given in Engle and Sheppard (2001).

Figure (1) Condition Correlation between stock markets

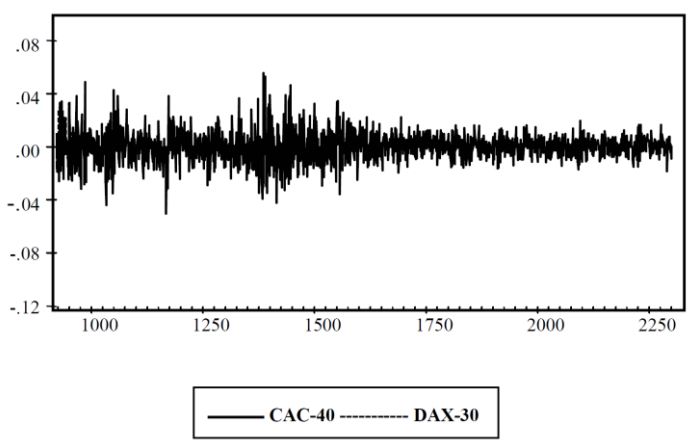

Table (4) Estimated Dynamic Condition Correlation

	CAC-DAX	T-stat	
param eter a DCC	.059395	13.25416	-302.0487
Parameter b DCC	.924962	74.23421	

VI. Conclusion:

The main purpose of this study is to examine the dynamic conditional correlation between German and French stock markets it also addresses the issue of whether the correlation increases between underlying assets, which has important practical and theoretical implication.

The analysis was carried out using DCC model of Engle (2002) and developed by Sheppard (2002) .

The empirical results showed that DAX30 and CAC40 are highly correlated and this may be due to fixing of the exchange rates between Germany and French stock markets in (1999) and the monetary union has strengthened real integration among its members. This confirms the results reported by Cappiello, et, al.(2003) and Bale (2002).

The correlation between French and German indices increased since mid-sample period, which is obviously influenced by the fixing of the exchanges rates in 1999 between the two countries. So, diversification strategies based on market indexes are now less attractive because of the increased correlation among the two stock markets, which is consistent with Gikas et. al (2006).

We cannot reject the restriction that parameters of the correlation process are summed up to one. Therefore, we can reject the presence of deterministic time trend but there is evidence that market indices correlation is influenced by a stochastic trend.

The results strongly confirm at the standard 5% significant level, that the stock index series are not stationary in level, but are stationary in first differences; or integrated according to order I(1). This means there is no stability long-run relationship among stock markets.

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