10th National Convention on Statistics (NCS)
EDSA Shangri-La Hotel
October 1-2, 2007

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ABSTRACT

DCC models are used to determine the linkage of East Asian stock markets. The results show the presence of largely positive conditional correlations among the stock market returns that are highly persistent. Asymmetric effect is also confirmed between blocks of stock markets.

Keywords: dynamic conditional correlation, asymmetric effect

I. Introduction

The integrated financial markets worldwide have impact on the correlation of asset returns. Institutional investors minimize the risk by hedging on uncorrelated assets in different sectors and countries. But correlation varies between assets classes across time so it is necessary to understand this interaction to enable investors to adjust to changes in the risk in their portfolios. Billio, et al. (2003) pointed out the importance of accounting for the correlation between different types of assets in building an optimal portfolio.

The emerging markets in East Asia have attracted institutional investors for some years now because of the high returns on equity investments. There are some studies that estimated the conditional correlations of stock markets in East Asia like Tse & Tsui (2002), Cappiello, et al. (2006) and Hakim & McAleer (2007) using bivariate conditional correlations models. This study however will estimate simultaneously the conditional correlations of all ten stock market returns of Australia, China, Hong Kong, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea and Taiwan. This will take into consideration all the simultaneous interactions which may be present in the region.

II. Dynamic Conditional Correlation Models

In modeling conditional correlation the Dynamic Conditional Correlation (DCC) of Engle (2002) will be used. DCC has spawned several models. The Block DCC of Billio, et al. (2003) for instance allowed for different dynamics between sectors in the stock market.

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Cappiello, et al. (2006) on the other hand accounted for the leverage effect in stock returns by proposing an Asymmetric DCC. While Cajigas & Urga (2005) and Vargas (2006) incorporated both asset class specific dynamics and asymmetric effect in their models: the Asymmetric Generalized DCC and Asymmetric Block DCC, respectively.

The dynamic conditional correlation models in this paper can be summarized into the following expression based on a general representation suggested by Vargas (2006). Let y_t is the $N \times 1$ vector of asset returns and $\Im_{t-1}$ is a sigma algebra of information up to time $t-1$, without loss of generality m_t is assumed to be zero:

$$y_t = m_t + e_t$$

$$e_t = H_t^{1/2} z_t \text{ where } z_t \sim N(0, I)$$

$$e_t \mid \Im_{t-1} \sim N(0, H_t).$$

The conditional covariance matrix H_t can be expressed as a function of the dynamic conditional correlation

$$H_t = D_t R_t D_t = \left(r_{ij,t} \sqrt{h_{ii,t} h_{jj,t}} \right)$$

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1}, \text{ where } Q_t^* = diag\left(\sqrt{q_{ii,t}} \right)$$

and Q_t follows the evolution

$$\left(\overline{Q} - a(L) \circ \overline{Q} - b(L) \circ \overline{Q} - h(L) \circ \overline{N} \right) + a(L) \circ (e_t^* e_t^{*\prime}) + b(L) \circ Q_t + h(L) \circ (n_t n_t').$$

Vargas (2006) showed that this representation nests the DCC, Block DCC, ADCC and AGDCC models by changing the specification of the $N \times N$ parameter matrices $a(L)$, $b(L)$ and $h(L)$.

III. Data

The data consists of end-of-the-week stock market indices from July 1997 to March 2005 for a total of 402 observations. The end-of-the-week approach takes the closing level of a stock market index for a given week; this minimizes the asynchronous trading periods of the regional markets and other issues related to closed markets on some days in the week due to holidays and other country-specific events.

The Philippine and Indonesian stock indices consist one block as these are closely related ASEAN markets; China and Hong Kong makes up another block accounting for the integration of the two beginning 1997 when Hong Kong became a special administrative region; South Korea and Taiwan in one block as the economic tigers of East Asia; Malaysia and Singapore in another block as the two largest economies in the ASEAN; Japan on its own; and similarly Australia.

IV. Results and Discussion

All five DCC models were estimated for the ten stock market index returns. The estimation of the parameters is sensitive to initial values using the nonlinear optimization algorithm L-BFGS-B in R Language. It cannot easily locate the global maximum of the likelihood function. This is a typical problem in large dimensional estimation. In order to find the best fit several initial values have been tried in the optimization. Tables 1 to 4 show the parameter estimates for the different DCC models. In Table 1, the highly restrictive model of DCC requires only two parameters to estimate while flexibility in determining conditional correlations between stock markets is best achieved in ABDCC, Table 4, with the downside of 63 parameters to estimate.

One important thing to note in the parameter estimates for Tables 1 to 4 is that the $b(L)$ is largely between 0.7 and 0.8 which implies that there is a strong persistence in the conditional correlations of stock returns in East Asia. This suggests that the impact of a shock on the correlation of markets lingers for some time. Figure 1, using ABDCC, shows that conditional correlations between ASEAN blocks (Philippines & Indonesia, Malaysia & Singapore) and the China and Hong Kong stock markets rose up at the onset of the Asian Financial Crisis in 1997, but at the same time from this period onwards there is a drop in correlation between ASEAN blocks and Australia, also Japan. Figures 1 to 3 also show that there is a large positive correlation between stock market returns except for correlations with either Japan or Australia.

The $a(L)$ which measures the short-run impact of volatility between blocks do not differ much when DCC, ADCC and BDCC are considered as shown in Tables 1 and 2. The range of impact is between 0.13 to 0.18, and these models imply that the impact is relatively similar between the different conditional correlations, while AGDCC in Table 3 does not budge within 0.38 and ABDCC provides a larger range of estimates, Table 4. With regard to asymmetric effect, the ADCC, AGDCC and ABDCC in Tables 1, 3 and 4 confirm its presence among stock returns.

V. Conclusion

The conditional correlations among stock market returns in East Asia imply that there is a large amount of risk in placing investments in this emerging market even if diversification is done within the region. Some hedging can be done when investment portfolios include Japan and Australia.

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Tables and Figures

Table 1 DCC and ADCC Parameter Estimates

	DCC	ADCC
$a(L) = (a_{ij})$	0.1308606	0.18763765
$b(L) = (b_{ij})$	0.7759320	0.78881048
$h(L) = (h_{ij})$	-	0.04574049

Table 2 BDCC Parameter Estimates

$a(L)$	PhiInd	ChiHK	KorTai	MalSG	Jap	Aus
PhiInd	0.152934	0.143063	0.142401	0.144086	0.148712	0.147785
ChiHK		0.154014	0.150329	0.14134	0.147804	0.149527
KorTai			0.159235	0.135436	0.142734	0.14455
MalSG				0.152992	0.145236	0.146663
Jap					0.153824	0.149997
Aus						0.153257

$b(L)$	PhiInd	ChiHK	KorTai	MalSG	Jap	Aus
PhiInd	0.697803	0.700322	0.700421	0.702023	0.700224	0.700122
ChiHK		0.697889	0.701077	0.702355	0.700038	0.700997
KorTai			0.698238	0.700818	0.700924	0.700466
MalSG				0.694259	0.700743	0.700675
Jap					0.698172	0.700461
Aus						0.69859

Table 3 AGDCC Parameter Estimates

	PhiInd	ChiHK	KorTai	MalSG	Jap	Aus
$diag\{a(L)\}$	0.3871346	0.3873258	0.3865723	0.3869431	0.3874862	0.3872967
$diag\{b(L)\}$	0.8367024	0.8366607	0.8366150	0.8366461	0.8366415	0.8366515
$diag\{h(L)\}$	0.2233414	0.2236261	0.2236404	0.2236410	0.2236604	0.2236044

Table 4 ABDCC Parameter Estimates

$a(L)$	PhiInd	ChiHK	KorTai	MalSG	Jap	Aus
PhiInd	0.18897	0.158090	0.183404	-0.09043	0.149086	0.148285
ChiHK		0.208736	0.272483	-0.14639	0.145462	0.147506
KorTai			0.312546	-0.37636	0.109499	0.135534
MalSG				0.638451	0.135657	0.126795
Jap					0.159171	0.157660
Aus						0.159927

$b(L)$	PhiInd	ChiHK	KorTai	MalSG	Jap	Aus
PhiInd	0.690846	0.700214	0.700549	0.706451	0.699667	0.699664
ChiHK		0.687322	0.700554	0.710326	0.699980	0.701917
KorTai			0.686969	0.708091	0.704590	0.700163
MalSG				0.676638	0.701989	0.701579
Jap					0.693762	0.699431
Aus						0.69458

$h(L)$	PhiInd	ChiHK	KorTai	MalSG	Jap	Aus
PhiInd	0.088583	0.057276	0.098895	-0.18957	0.049129	0.049283
ChiHK		0.106348	0.166442	-0.23196	0.047537	0.046401
KorTai			0.209343	-0.47783	0.024863	0.036774
MalSG				0.548623	0.038017	0.029791
Jap					0.060409	0.058859
Aus						0.059931

Figure1

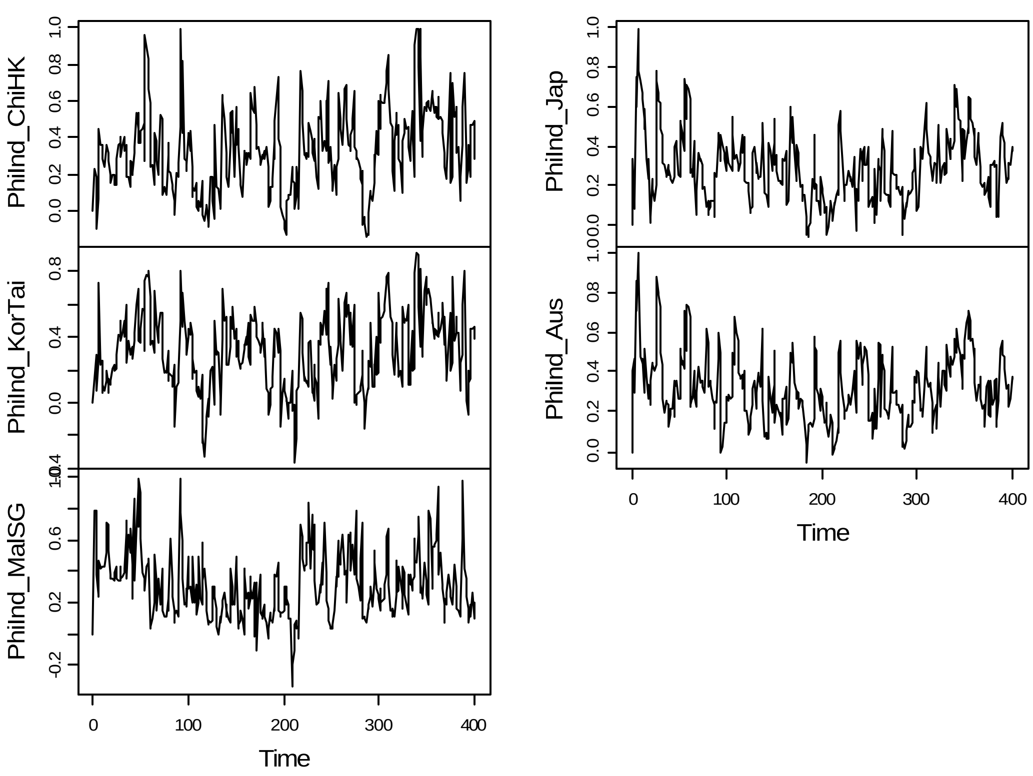
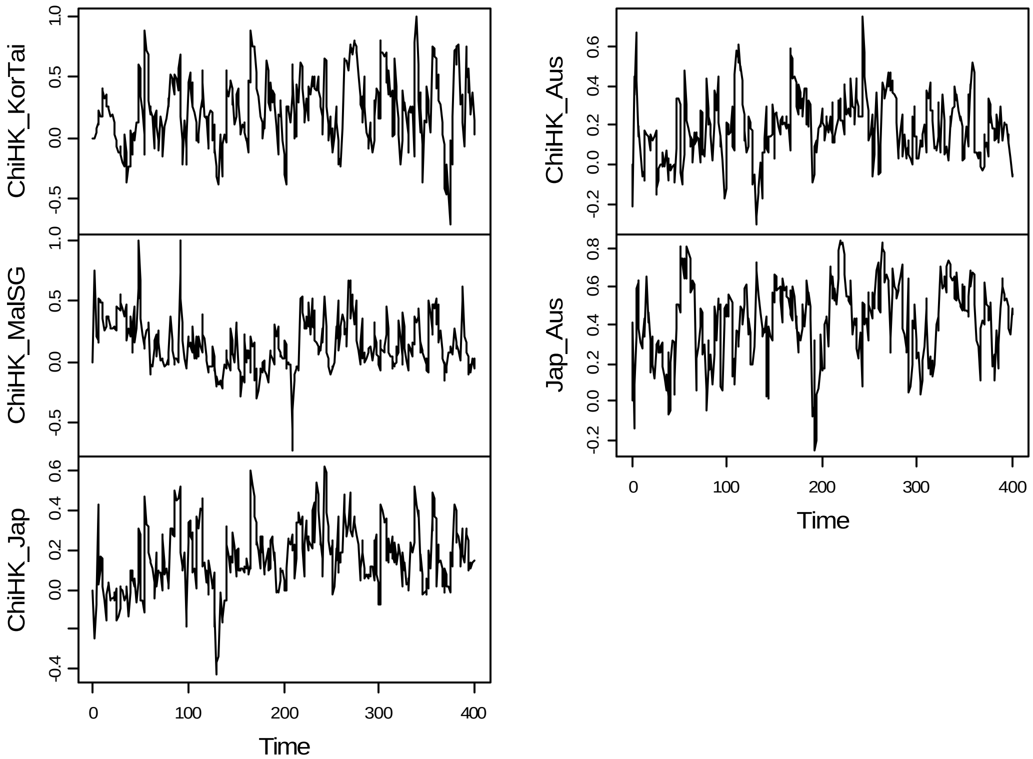
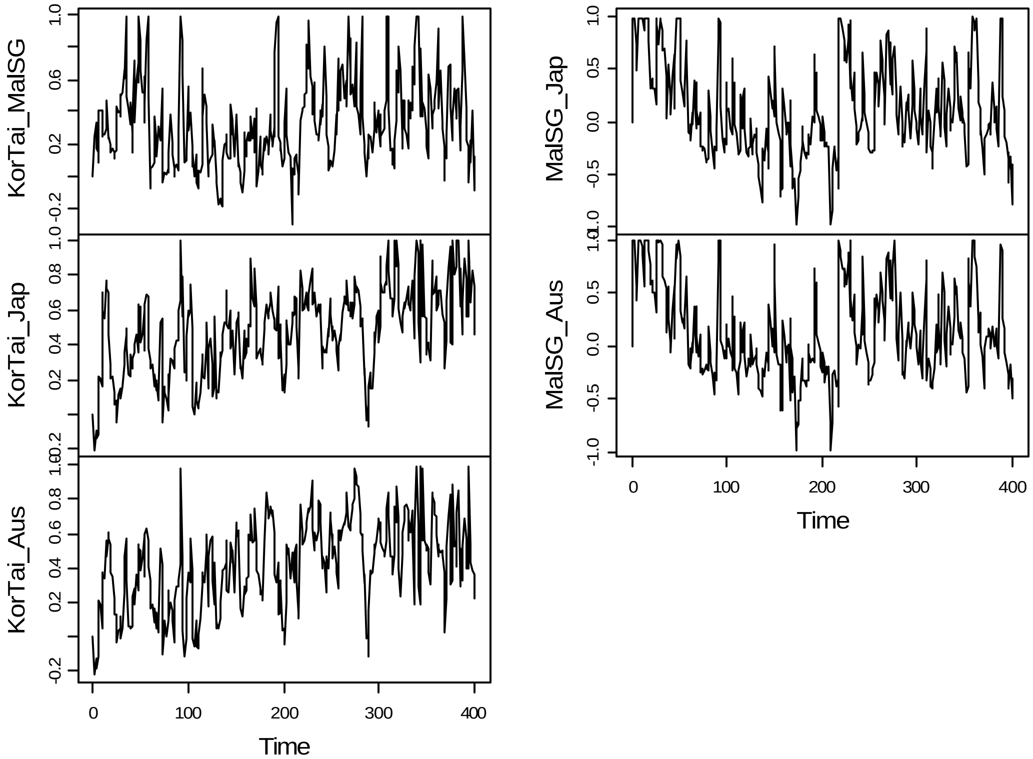


Figure2



ChiHK_KorTai
ChiHK_MalSG
ChiHK_Jap
ChiHK_Aus
Jap_Aus
Time
Time

Figure3



KorTai_MalSG
KorTai_Jap
KorTai_Aus
MalSG_Jap
MalSG_Aus
Time
Time